2103/2103C/2103G Modem Module

Installation and Operation Guide

TELEDYNE ISCO
Everywhereyoulook™

Part #69-2003-180
Copyright © 2002. All rights reserved, Teledyne Isco
Revision V, April 6, 2012

Foreword

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Teledyne Isco recommends that you read this manual completely before placing the equipment in service.

Although Teledyne Isco designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If the problem persists, call or e-mail the Teledyne Isco Technical Service Department for assistance. Simple difficulties can often be diagnosed over the phone.

If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by the Customer Service Department, including the use of the **Return Authorization Number** specified. **Be sure to include a note describing the malfunction.** This will aid in the prompt repair and return of the equipment.

Teledyne Isco welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

Teledyne Isco is continually improving its products and reserves the right to change product specifications, replacement parts, schematics, and instructions without notice.

Contact Information

Customer Service

Phone:	(800) 228-4373	(USA, Canada, Mexico)
	(402) 464-0231	(Outside North America)
Fax:	(402) 465-3022	
Email:	IscoCSR@teledyne.com	

Technical Support

Phone:	(800) 775-2965	(Analytical)
	(866) 298-6174	(Samplers and Flow Meters)
Email:	IscoService@teledyne.com	
Return equipment to:	4700 Superior Street, Lincoln, NE 68504-1398	

Other Correspondence

Mail to:	P.O. Box 82531, Lincoln, NE 68501-2531
Email:	IscoInfo@teledyne.com
Web site:	www.isco.com

Revised March 17, 2009

General Warnings

Before installing, operating, or maintaining this equipment, it is imperative that all hazards and preventive measures are fully understood. While specific hazards may vary according to location and application, take heed of the following general warnings:

⚠ WARNING

Avoid hazardous practices! If you use this instrument in any way not specified in this manual, the protection provided by the instrument may be impaired.

⚠ AVERTISSEMENT

Éviter les usages périlleux! Si vous utilisez cet instrument d'une manière autre que celles qui sont specifiées dans ce manuel, la protection fournie de l'instrument peut être affaiblie; cela augmentera votre risque de blessure.

Hazard Severity Levels

This manual applies *Hazard Severity Levels* to the safety alerts, These three levels are described in the sample alerts below.

⚠ CAUTION

Cautions identify a potential hazard, which if not avoided, may result in minor or moderate injury. This category can also warn you of unsafe practices, or conditions that may cause property damage.

⚠ WARNING

Warnings identify a potentially hazardous condition, which if not avoided, could result in death or serious injury.

⚠ DANGER

DANGER – limited to the most extreme situations to identify an imminent hazard, which if not avoided, will result in death or serious injury.

Hazard Symbols

The equipment and this manual use symbols used to warn of hazards. The symbols are explained below.

Hazard Symbols	
Warnings and Cautions	
	The exclamation point within the triangle is a warning sign alerting you of important instructions in the instrument's technical reference manual.
	The lightning flash and arrowhead within the triangle is a warning sign alerting you of "dangerous voltage" inside the product.
Symboles de sécurité	
	Ce symbole signale l'existence d'instructions importantes relatives au produit dans ce manuel.
	Ce symbole signale la présence d'un danger d'électocution.
Warnungen und Vorsichtshinweise	
	Das Ausrufezeichen in Dreieck ist ein Warnzeichen, das Sie darauf aufmerksam macht, daß wichtige Anleitungen zu diesem Handbuch gehören.
	Der gepfeilte Blitz im Dreieck ist ein Warnzeichen, das Sei vor "gefährlichen Spannungen" im Inneren des Produkts warnt.
Advertencias y Precauciones	
	Esta señal le advierte sobre la importancia de las instrucciones del manual que acompañan a este producto.
	Esta señal alerta sobre la presencia de alto voltaje en el interior del producto.

2103 Modem Module

Table of Contents

Section 1 Introduction

1.1 Introduction 1-1
1.2 Product Description 1-1
1.3 Identifying Module Components 1-2
1.4 Technical Specifications 1-4
1.5 Safety Symbols and Hazard Alerts 1-6
1.6 Technical Service 1-6

Section 2 Preparation and Installation

2.1 Unpacking Instructions 2-1
2.2 Safety 2-1
2.3 Installation 2-2
2.3.1 Latches - Locking and Unlocking 2-2
2.3.2 Communication Connectors 2-2
2.3.3 Stacking Modules 2-3
2.4 Telephone Line Connection (2103 only) 2-3
2.4.1 Modem Cable Connection 2-5
2.4.2 Connection Without the Modem Cable 2-5
2.5 Connecting to Flowlink 2-6
2.5.1 Modem Site Connection 2-9
2.5.2 Setting Up Text Messaging 2-10
2.6 Power Conservation for Cellular Modems 2-12
2.6.1 Equation 2-13
2.7 Pushed Data Capability 2-14

Section 3 2103C Cellular Modem Module

3.1 Overview 3-1
3.1.1 Data Retrieval 3-1
3.1.2 Text Messaging 3-1
3.1.3 Stacking / Compatibility 3-1
3.1.4 Cellular Service 3-1
3.2 Antenna Options 3-2
3.3 Antenna: Early Version 3-2
3.3.1 Magnetic Mount
(part #68-2000-032) 3-3
3.3.2 In-Street
(part #68-2000-031) 3-3
3.3.3 Manhole Lid-Mount
(part #60-5314-779) 3-4
3.3.4 Connecting the Antenna 3-4
3.4 Antenna: Later Version 3-6
3.4.1 Magnetic Mount
(part #60-2004-566) 3-6
3.4.2 In-Street
(part #60-2004-564) 3-7
3.4.3 Manhole Lid-Mount

(part #60-5314-820) 3-7

Section 4 2103G Cellular Modem Module

4.1 Overview 4-1
4.1.1 Data Retrieval 4-1
4.1.2 Text Messaging 4-1
4.1.3 Stacking / Compatibility 4-1
4.2 SIM Card 4-1
4.3 Antenna Options 4-4
4.4 Antenna: Early Version 4-4
4.4.1 Magnetic Mount
(part #68-2000-047) 4-5
4.4.2 In-Street
(part #68-2000-031) 4-5
4.4.3 Manhole Lid-Mount
(part #60-5314-779) 4-6
4.4.4 Connecting the Antenna 4-6
4.5 Antenna: Current Version 4-8
4.5.1 Magnetic Mount
(part #60-2004-565) 4-8
4.5.2 In-Street
(part #60-2004-564) 4-9
4.5.3 Manhole Lid-Mount
(part #60-5314-820) 4-9
4.6 Setting Up The Access Point Name 4-10

Section 5 Modbus Protocol

5.1 Introduction 5-1
5.2 Operation 5-1
5.2.1 Establishing Communication 5-2
5.2.2 Module Addressing 5-2
5.3 Configurations 5-3
5.4 Glossary of Terms 5-4
5.5 Common Acronyms 5-5
5.6 Register Specifications 5-5

Section 6 Maintenance

6.1 Maintenance Overview 6-1
6.1.1 Cleaning 6-1
6.2 Maintenance Kit 6-1
6.3 Desiccant 6-2
6.3.1 Replacing the Desiccant 6-2
6.3.2 Reactivating the Desiccant 6-2
6.4 Hydrophobic Filter 6-3
6.5 O-Rings 6-3
6.6 How to Obtain Service 6-3

Appendix A Replacement Parts

A.1 Replacement Parts A-1
A.1.1 2103 Modem Module A-2
A.1.2 2103C/G Cellular Module (early version) A-5
A.1.3 2103C/G Cellular Module (current version) A-8
A.1.4 In-Street Antenna (early version) A-11
A.1.5 Current Antennas A-13

Appendix B Accessories

B.1 How to Order. B-1
B.2 General Accessories B-1
B.2.1 Antennas B-1

Appendix C Material Safety Data Sheets

C.1 Overview C-1

List of Figures

1-1 2103 Modem Components - Top View 1-2
1-2 2103 Modem Components - Bottom View 1-3
1-3 2103 Communication Connector Pins 1-5
1-4 2103 Modem Cable Connector 1-5
2-1 Connecting the Modem Cable 2-5
2-2 2103 Modem Cable Connector 2-5
2-3 Flowlink connect screen (version 5.10.616) 2-6
2-4 Site resolution screen 2-7
2-5 Site Information screen 2-8
2-6 Devices screen - disconnected from site 2-9
2-7 Dialout phone numbers and alarm conditions 2-10
2-8 TAP Service Parameters 2-11
2-9 Power control window 2-12
2-10 Equation builder for power control 2-13
2-11 Data tab 2-14
3-1 Early and current versions of the 2103C antenna connector 3-2
3-2 2103C magnetic mount antenna: early version 3-3
3-3 2103C buried in-street antenna: early version 3-3
3-4 2103 Manhole lid-mount antenna: early version 3-4
3-5 Protective connector shell pieces for early antennas 3-4
3-6 Connecting an antenna to the 2103C 3-5
3-7 Antenna connected to the 2103C 3-5
3-8 2103C magnetic mount antenna: later version 3-6
3-9 2103C buried in-street antenna: later version 3-7
3-10 2103 Manhole lid-mount antenna: later version 3-7
4-1 Accessing the SIM card on the bottom of the module 4-2
4-2 SIM card slot and release switch 4-2
4-3 Inserting the SIM card into the module 4-3
4-4 Early and current versions of the 2103G antenna connector 4-4
4-5 2103G magnetic mount antenna: early version 4-5
4-6 2103G in-street antenna: early version 4-5
4-7 2103G Manhole lid-mount antenna: early version 4-6
4-8 Protective connector shell pieces for early antennas 4-6
4-9 Connecting an antenna to the 2103G 4-7
4-10 Antenna connected to the 2103G modem. 4-7
4-11 2103G magnetic mount antenna: current version 4-8
4-12 2103G buried in-street antenna: current version 4-9
4-13 2103G Manhole lid-mount antenna 4-9
5-1 Configuration example 5-3

List of Tables

1-1 2103 Modem Module Components - Top View 1-2
1-2 2103 Modem Module Components - Bottom View 1-3

1-3 2103 Modem Module Technical Specifications 1-4
1-4 Specifications – 2191 Battery Module 1-4
1-5 2103 Communication Connector Pins (2103 only) 1-5
5-1 Modbus ASCII Address 1 Register Definitions 5-6
5-2 Modbus ASCII Address 2+(N-1) Register Definitions 5-6
5-3 2100 Measurement Parameters by Model Number* 5-8

2103 Modem Module

Section 1 Introduction

1.1 Introduction

This instruction manual is designed to help you gain a thorough understanding of the operation of the 2103, 2103C, and 2103G Modem Modules. Teledyne Isco recommends that you read this manual completely before placing the equipment into service.

Information in this manual pertains to the 2103 phone line modem and the 2103C and 2103G cellular modems, except for the sections specific to one method of communication or the other.

For information specific to the setup and operation of the 2103C CDMA Cellular Modem, refer to Section 3, *2103C Cellular Modem Module*.

For information specific to the setup and operation of the 2103G GSM Cellular Modem, refer to Section 4, *2103G Cellular Modem Module*.

1.2 Product Description

The 2103 Modem is a portable data interrogation unit designed to transmit data from Isco's 2100 Series flow modules, which measure parameters of open channel flow streams. It works in conjunction with Isco's *Flowlink* software.

The 2103 Modem can be located anywhere within a stack of up to three other 2100 Series networked modules, using the same locking mechanism that connects the 2100 Series modules to each other. The 2103 is compatible with Isco's 2150 Area Velocity flow module, 2110 Ultrasonic flow module, 2101 Field Wizard, and 2102 wireless module. It is powered by Isco's 2191 battery module.

All enclosures are rated NEMA 4X, 6P(IP68). The permanently sealed enclosures are designed to meet the environmental demands of many sewer flow monitoring applications. All connections between modules, sensors, and communication cables lock in place. The locking mechanisms strongly secure the components and ensure a watertight seal.

1.3 Identifying Module Components

Figures 1-1 and 1-2 identify the key components of the 2103 Modem Module.

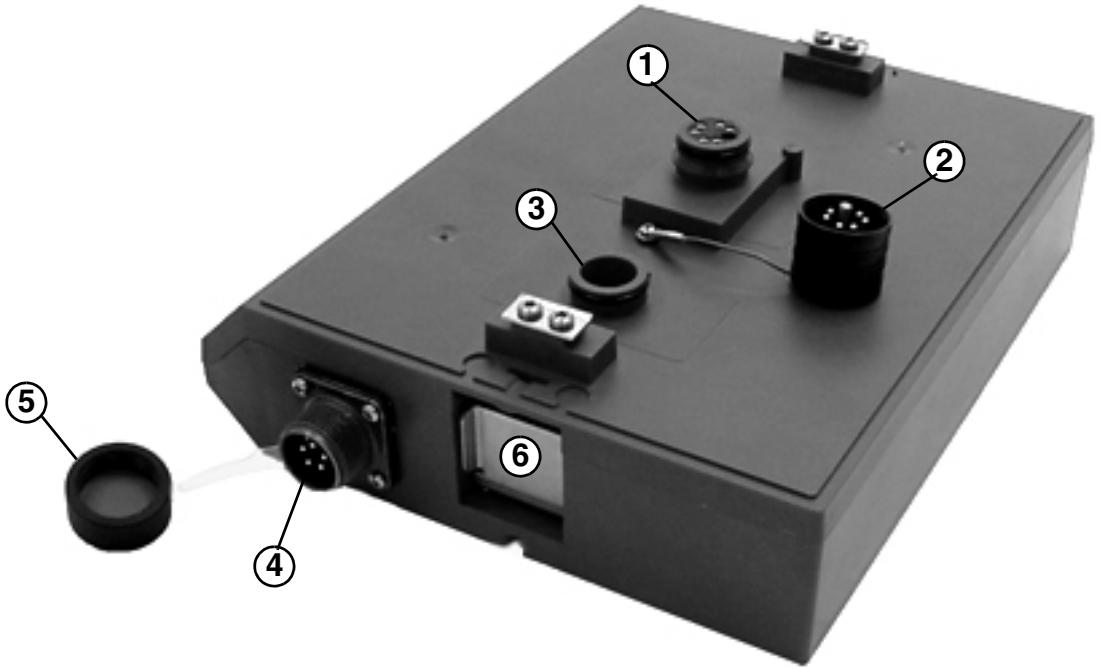


Figure 1-1 2103 Modem Components - Top View

Table 1-1 2103 Modem Module Components - Top View

Item No.	Name	Description
1	Communication Connector	This port is used to connect the 2103 Modem to other modules in a stack.
2	Connector Cap	Insert into the communication connector when it is not in use to protect the connector from moisture damage. When the connector is in use, store the connector cap in the cap holder.
3	Cap Holder	Stores the connector cap when the communication connector is in use.
4	Modem Cable Connector (2103 only)	Used to connect the modem cable to the 2103 Modem Module. (On the 2103C and 2103G modules, this side connector has a slightly different appearance, and is used to connect either the magnetic mount or potted antenna.)
5	Modem Cable Connector Cap	Insert into the modem cable connector when the connector is not in use to protect the connector from damage.
6	Latch Release	Push in to unlock the module from a stack.

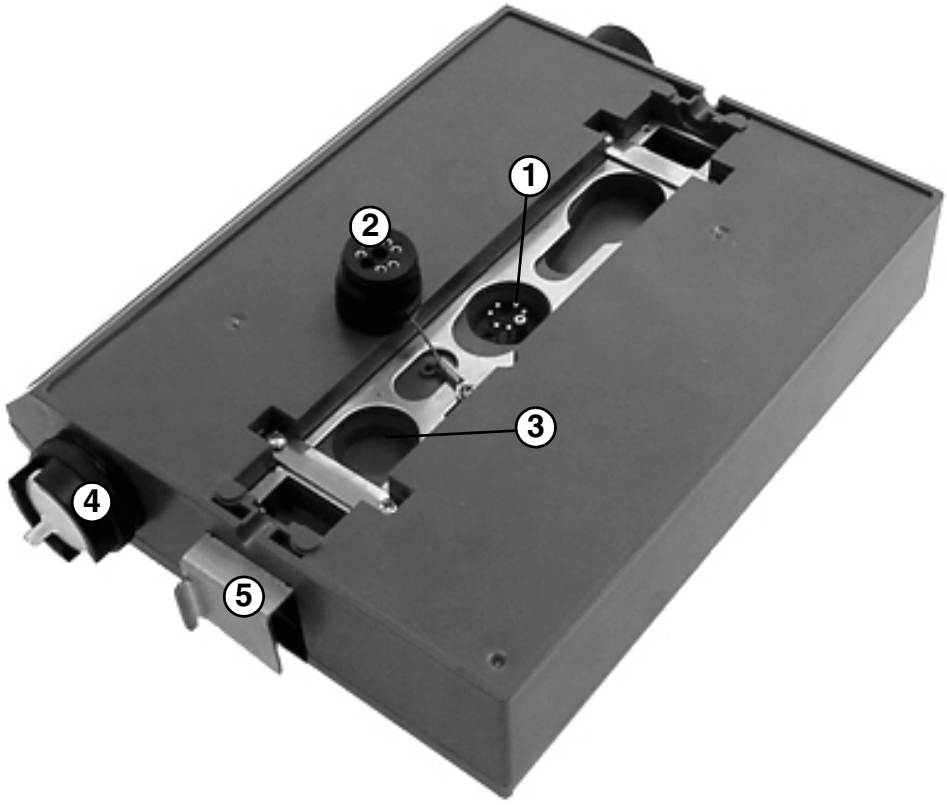


Figure 1-2 2103 Modem Components - Bottom View

Table 1-2 2103 Modem Module Components - Bottom View

Item No.	Name	Description
1	Communication Connector	This connects the 2103 Modem to other 2100 Series modules in the stack and is used to transfer data.
2	Connector Plug	Insert into the communication connector when not in use to protect the connector from moisture damage. When the connector is in use, store the connector plug in the holder.
3	Plug Holder	Stores the connector cap when the communication connector is in use.
4	Desiccant Cartridge and Hydrophobic Filter	Prevents moisture from entering the unit.
5	Latch	Push in to lock the module in a stack.

1.4 Technical Specifications

Technical specifications for the 2103 Modem Module are given in Table 1-3. Technical specifications for the 2191 Battery Module are given in Table 1-4.

Table 1-3 2103 Modem Module Technical Specifications

Dimensions	Length = 10.5 inches (26.7 cm) Width = 7.5 inches (19 cm) Height = 2.9 inches (7.4 cm)
Weight	2 lbs. (.9 Kg)
Material	High-impact molded polystyrene
Enclosure	NEMA 4X, 6P, IP68 (2103), IP67 (2103c)
Power	6.6 to 16.6 VDC, 141 mA typical at 12 VDC, 0.41 mA standby
Operating Temperature	-4° to 140°F (-20° to 60°C)
Storage Temperature	-40° to 140°F (-40° to 60°C)
Typical Battery Life	291 days*
Modulation Standards Supported (2103 only)	Bell 103, Bell 212, V.21, V.22, V.22 bis, V.23, V.32, V.32 bis, V.34
Communication Speeds Supported	300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800, 31200, 33600 bps
Error Correction Standards Supported	V.42 LAPM, MNP-2, MNP-4, MNP-10
Data Compression Standards Supported	V.42 bis, MNP-5

* Actual battery life will vary depending upon configuration. The figure given assumes interrogation with Flowlink 4.13 once a week, with a site configuration of a 2103, 2150, and 2191 (using Energizer 529 batteries) and a connection speed of 33600 baud. The 2150 was configured to record level, velocity, flow rate every 15 minutes, total flow, and battery voltage every 24 hours.

Table 1-4 Specifications – 2191 Battery Module

Size (H×W×D)	6.0 × 9.6 × 7.6 in.	15.2 × 24.4 × 19.3 cm
Weight *(without batteries)*	3.2 lbs.	1.4 kg
Materials	ABS plastic, stainless steel	
Enclosure *(self-certified)*	NEMA 4X, 6P	IP68
Batteries	6V alkaline lantern or lead-acid lantern, quantity 2	
Capacity		
Alkaline Lantern Batteries	25 Ahrs	
Lead-acid Lantern Batteries	5 Ahrs	

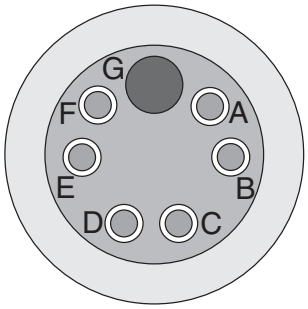


Table 1-5 2103 Communication Connector Pins (2103 only)

Pin	Name	Description
A	LONA	Neuron differential transceiver Data A
B	LONB	Neuron differential transceiver Data B
C	VIN+	Positive power supply voltage input (+12 VDC nominal)
D	VIN–	Negative power supply voltage input (0 VDC nominal)
E	RCVUP	PC data receiver inverted input
F	XMTUP	PC data transmit inverted output
G	Key	Aligns connector pins

Figure 1-3 2103 Communication Connector Pins

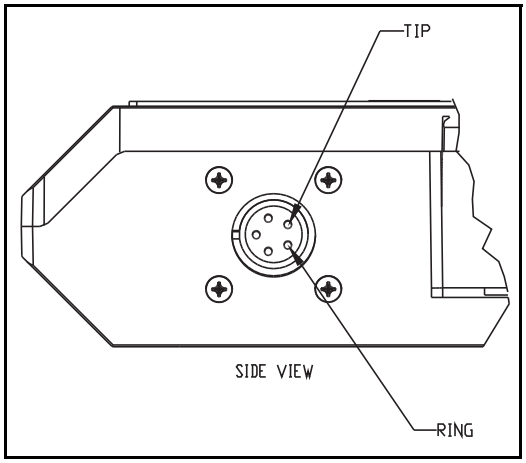


Figure 1-4 2103 Modem Cable Connector

1.5 Safety Symbols and Hazard Alerts

This icon identifies a general hazard and is accompanied with details about the hazard. The instruction manual identifies the hazardous condition and any steps necessary to correct the condition. The manual presents this information in one of two ways:

⚠ CAUTION

Cautions identify a potential hazard, which if not avoided, may result in minor or moderate injury. This category can also warn you of unsafe practices, or conditions that may cause property damage.

⚠ WARNING

Warnings indicate potentially hazardous conditions. If you do not avoid these risks, they could cause you death or serious injury.

1.6 Technical Service

Although Teledyne Isco designs reliability into all of its equipment, there is always the possibility of a malfunction occurring. You can use this manual to help in diagnosing and repairing any malfunctions. If the malfunction persists, call or write the Teledyne Isco Technical Service Department for assistance:

Teledyne Isco
Technical Service Department
P.O. Box 82531
Lincoln, NE 68501
866-298-6174 or 402-464-0231
FAX: 402-465-3001
e-mail: IscoService@teledyne.com

Simple difficulties can often be diagnosed over the phone. If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by the Technical Service Department, including the use of the Return Authorization Number specified. Be sure to include a note describing the malfunction. This will aid in the prompt repair and return of the equipment.

2103 Modem Module

Section 2 Preparation and Installation

2.1 Unpacking Instructions

When the system arrives, inspect the contents for any damage. If there is damage, contact the delivery company and Teledyne Isco (or its agent) immediately.

⚠ WARNING

If there is any evidence that any items may have been damaged in shipping, do not attempt to install the unit. Please contact Teledyne Isco (or its agent) for advice.

Teledyne Isco
Customer Service Dept.
P.O. Box 82531
Lincoln, NE 68501 USA

Phone: (800) 228-4373
Outside USA & Canada call:
(402) 464-0231

FAX: (402) 465-3022

E-mail: IscoInfo@teledyne.com

When you unpack the system, check the items against the packing list. If any parts are missing, contact the delivery company and Teledyne Isco's Customer Service Department. When you report missing part(s), please indicate them by part number. In addition to the main packing list, there may be other packing lists for various sub-components.

It is recommended that you retain the shipping cartons as they can be used to ship the unit in the event that it is necessary to transport the system.

Please complete the registration card and return it to Teledyne Isco.

2.2 Safety

⚠ WARNING

Avoid hazardous practices! If you use these instruments in any way not specified in this manual, the protection provided by the instruments may be impaired; this will increase your risk of injury.

⚠ WARNING

The installation and use of this product may subject you to hazardous working conditions that can cause you serious or fatal injuries. Take any necessary precautions before entering a worksite. Install and operate this product in accordance with all applicable safety and health regulations, and local ordinances.

The 2100 Series components are often installed in confined spaces. Some examples of confined spaces include manholes, pipelines, digesters, and storage tanks. These spaces may become

hazardous environments that can prove fatal for those unprepared. These spaces are governed by OSHA 1910.146 and require a permit before entering.

2.3 Installation

Follow the instructions below to install your 2103 Modem. Most of these instructions are similar for the 2103C and 2103G, but if you have one of those modules, read Section 3 or 4 for additional installation information.

2.3.1 Latches - Locking and Unlocking

Latches must be operated to stack and unstack the modules in a Series 2100 stack. The mechanisms are the same for the 2103 Modem and other 2100 Series modules. Detailed instructions with photos can be found in your 2150 instruction manual.

Take a moment to familiarize yourself with operating the latches. You must unlock the latch to place the module on top of another module in a stack. The latch is unlocked by pushing in the latch release on the right side of the module. To lock the latch, push in the latch on the left side of the module.

⚠ CAUTION

The latch can be damaged by applying too much force. Never press on both sides at the same time. Do not force the latch if it is obstructed. While some degree of pressure must be applied to slide the latch, the ends of the latches should never bend more than 1/8".

☑ *Note*

Latches will "click" when they are fully locked and unlocked.

2.3.2 Communication Connectors

Connecting the 2103 Modem module involves uncapping and capping communication connectors. When a communication connector is not in use, the connector should always be capped. The cap will seal the connector to prevent corrosion, and will improve communications.

When a communication connector is in use, store the cap on the holder next to the connector. The communication connector will be sealed by its mating connector.

Detailed instructions and photos can be found in your 2150 or 2110 instruction manual.

⚠ CAUTION

Caps **PUSH ON** and **PULL OFF**. Do not rotate the caps to remove them from the connectors.

☑ *Note*

For modules to correctly stack and lock together, protective caps between the modules must be stored on the holders.

2.3.3 Stacking Modules

The 2103 Modem Module can be located anywhere within a stack of up to three 2100 Series networked modules. It will draw its power from the battery module located in the stack.

To connect the 2103 with a 2100 Series module, refer to the following instructions.

1. On the top of the 2100 Series module, remove the cap and stow it on the holder. This exposes the communication connector on the module.
2. Inspect the module's communication connector. It should be clean and dry. Damaged O-rings must be replaced.
3. Unlock the 2103's latch by pressing in on the latch release (right side).
4. Underneath the 2103, remove the cap from the lower communication connector and stow it in the holder.
5. Lock the latch. Locking the latch correctly seats and aligns the lower cap in its holder.
6. Position the 2103 over the 2100 Series module. Align the connectors and lower the 2103 onto the other module.
7. Unlock the 2103's latch by pressing in on the latch release (right side).
8. Firmly press the modules together and lock the 2103's latch (left side).

The communications indicator will blink during the start-up routine to indicate the 2103 is operating.

2.4 Telephone Line Connection (2103 only)

The FCC (Federal Communications Commission) governs communications over telephone lines. Your local telephone company will provide you with the line between the 2103 Modem and your computer. Contact them for connection information.

The 2103 Modem Module is in compliance with FCC part 68 rules. However:

☑ Note

In tests conducted by the Communication Certification Laboratory, the 2103 Modem did not pass conducted RF testing on telephone line at 5 MHz, 3V RMS. For details, see international standard EN 61000-4-6.
In the event of this failure, the modem may be subject to disconnection.

Accordingly, the FCC requires the following information be published:

☑ Note

The 2103 Modem is designed to be used on standard device telephone lines. It connects to the telephone by means of a standard jack called the USOC RJ-11C. Connection to telephone-company-provided coin service (central office implemented systems) is prohibited, and connection to party lines

service is subject to state tariffs.

Changes in Attestation Procedure for Plugs and Jacks

Isco attests that the network interface plugs or jacks used on this equipment comply with and will continue to comply with the mechanical requirements specified in Part 58, sub-part F, specifically the dimensions, tolerances and metallic plating requirements. The compliance of these connectors will be assured by purchase specifications and incoming inspection. Documentation of such specifications and/or inspections will be provided to the FCC within 30 days of their request for the same.

Telephone Company Procedures

The goal of the telephone company is to provide you with the best service it can. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations or procedures. If these changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service.

In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment which you have connected to your telephone line. Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN); both of these items are listed on the equipment label. The sum of all the RENs on your telephone lines should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be usable on a given line. Consult your telephone provider.

If Problems Arise: If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they will notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and will be informed of your right to file a complaint with the FCC. Contact your local telephone service provider if you have any questions about your phone line.

In the event repairs are needed on the 2103 Modem, they should be performed by Teledyne Isco or its authorized representative. For information, contact the Teledyne Isco Customer Service Department at (800) 228-4373 or (402) 464-0231.

2.4.1 Modem Cable Connection

After you have installed the 2103 on the stack, you need to attach the modem cable so the module can be connected to a phone line.

Remove the connector cap from the 5-pin circular modem cable connector on the right hand side of the 2103. Attach the modem cable to the connector (Figure 2-1), and then connect the other end of the modem cable to a standard telephone jack (USOC RJ-11C).

Figure 2-1 Connecting the Modem Cable

2.4.2 Connection Without the Modem Cable

If desired, the 2103 can be connected to a standard telephone line by attaching the telephone line cable to a connector that mates with the 2103's 5-pin circular modem cable connector (Figure 2-2). Be sure that you have a water tight seal on your wire connections.

For your reference, the modem cable uses a 5-pin amphenol socket, MS3106A-5S.

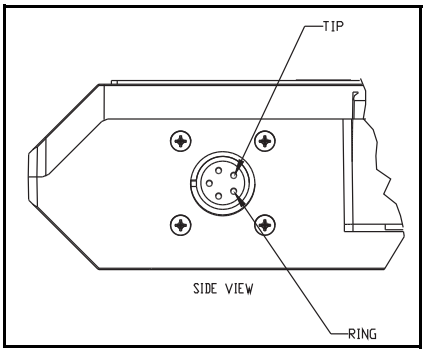


Figure 2-2 2103 Modem Cable Connector

2.5 Connecting to Flowlink

Once the system is installed, you will configure it in a new or existing site using Isco's Flowlink software.

> **Note**
>
> The 2103 Module requires Flowlink 4.13 or later. Earlier versions do not support the modem.

The first time you connect to the site, you must connect your computer directly to the stack using Isco's RS232 connect cable (part #60-2004-046) or USB port connect cable (part #60-2004-507). Open Flowlink and go to the Connect screen (Figure 2-3) by either selecting it from the pull down menu or clicking on the Quick Connect icon.

Make sure the connection Type is **Direct**, and click on the 2100 Instrument icon to connect. Upon initial connection, Flowlink creates a site file and adds it to the database. If the system detects the addition of a new module to an existing site, it will display the Site Resolution screen (Figure 2-4). Otherwise, it will display the Site Info screen (Figure 2-5).

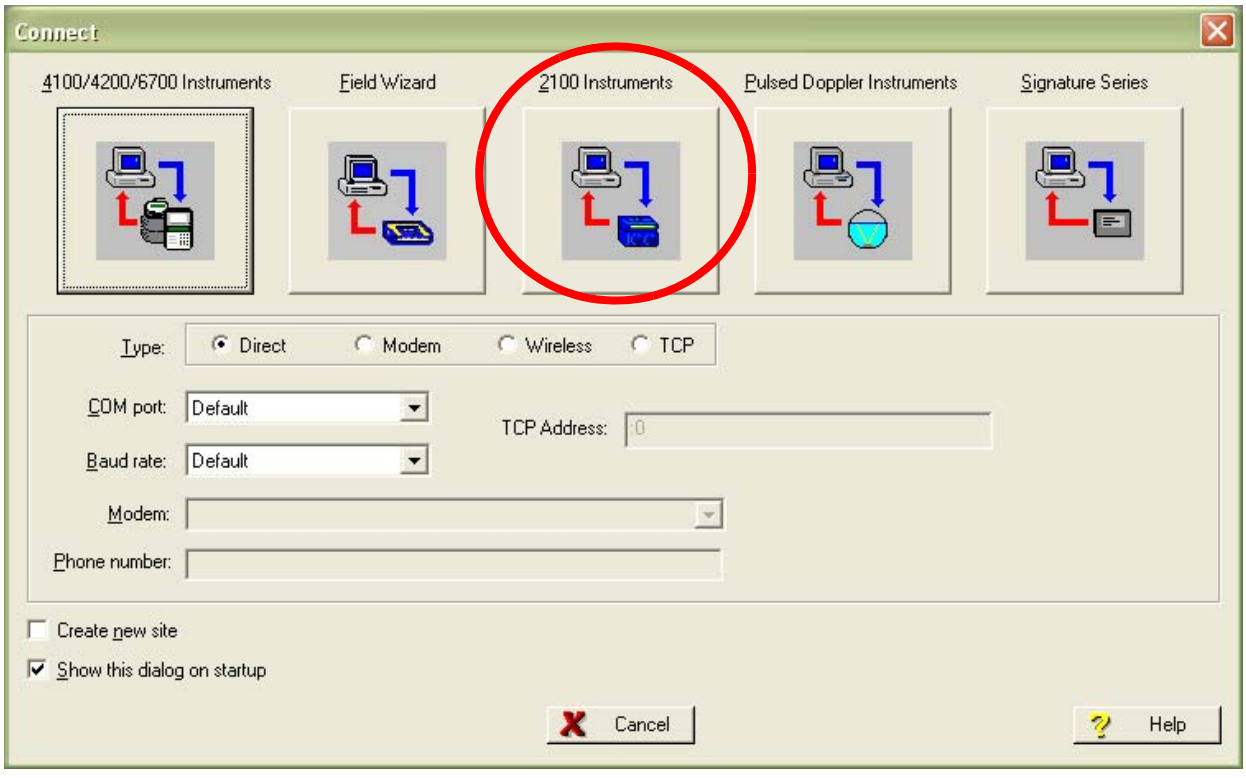


Figure 2-3 Flowlink connect screen (version 5.10.616)

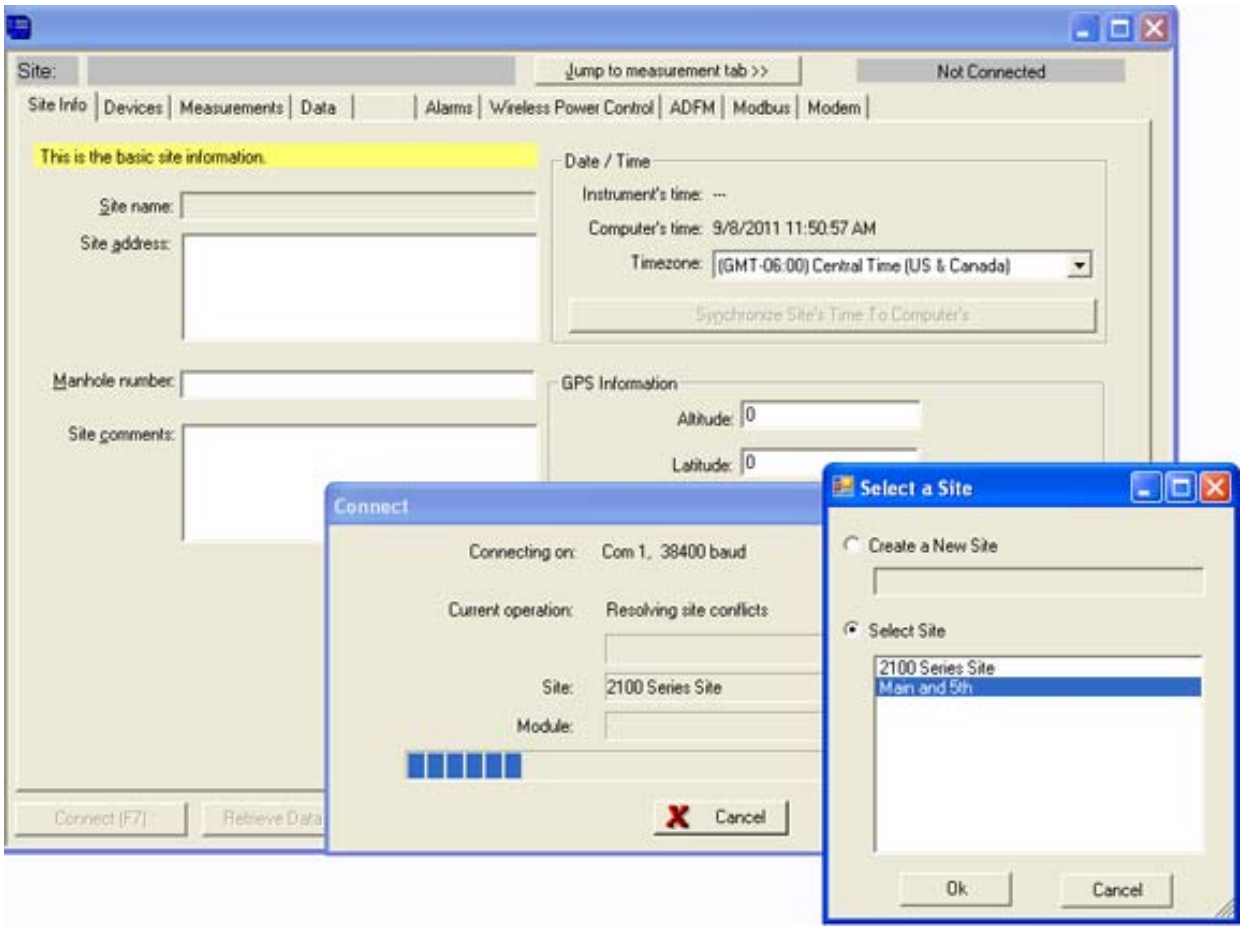


Figure 2-4 Site resolution screen

To add the new module to an existing site, select the appropriate site and click OK. To create a new site, select Create a New Site. Click in the name field, enter the name for the site, and click OK. Upon connection, the Site Info tab will appear.

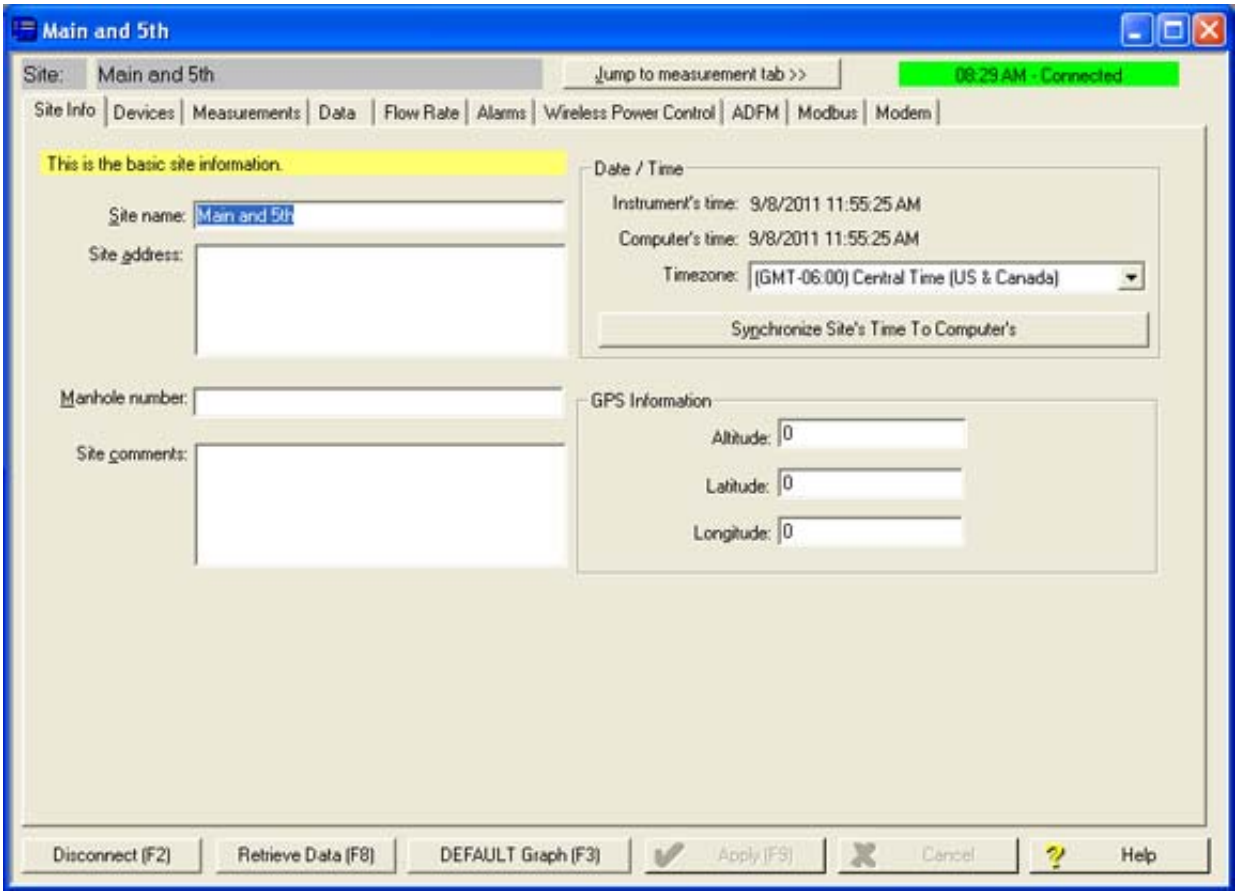


Figure 2-5 Site Information screen

2.5.1 Modem Site Connection

You must set up the Connection Information for the site. These settings are on the Devices tab (Figure 2-6). Click the Disconnect button to activate the fields.

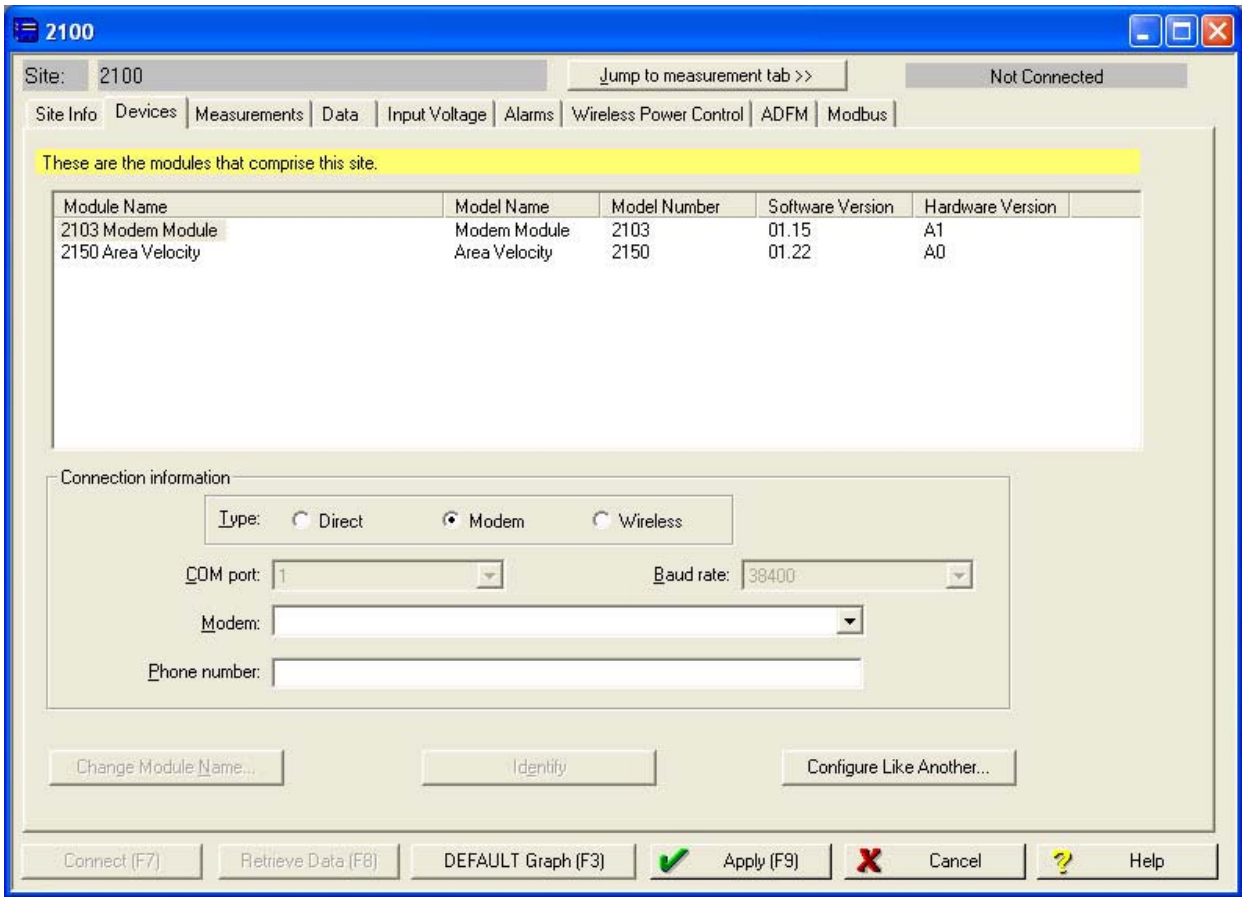


Figure 2-6 Devices screen - disconnected from site

Select the Modem radio button. From the pull down list, select the modem in Windows that will be used to call the 2103. The default modem will appear in the Modem field. To select a different modem for this site only, click the arrow to view a pull-down list containing all modems recognized by your Windows operating system.

Enter the 2103 modem's phone number and click Apply to save your settings.

If your cellular service is set up and ready for use through your service provider, you can now connect to your modem module via cellular connection.

> ☑ ***Note***
>
> For systems using the cellular modem, a Power Control method is highly recommended to conserve battery power. Refer to Section 2.6.

2.5.2 Setting Up Text Messaging

To program the 2103C or 2103G for text messaging, you must have the Telocator Alphanumeric Protocol (TAP) or Short Message Service (SMS) server number and parameter settings of your cell phones and/or pagers.

1. Make sure you are connected to the site, and select the Alarms tab (Figure 2-7).

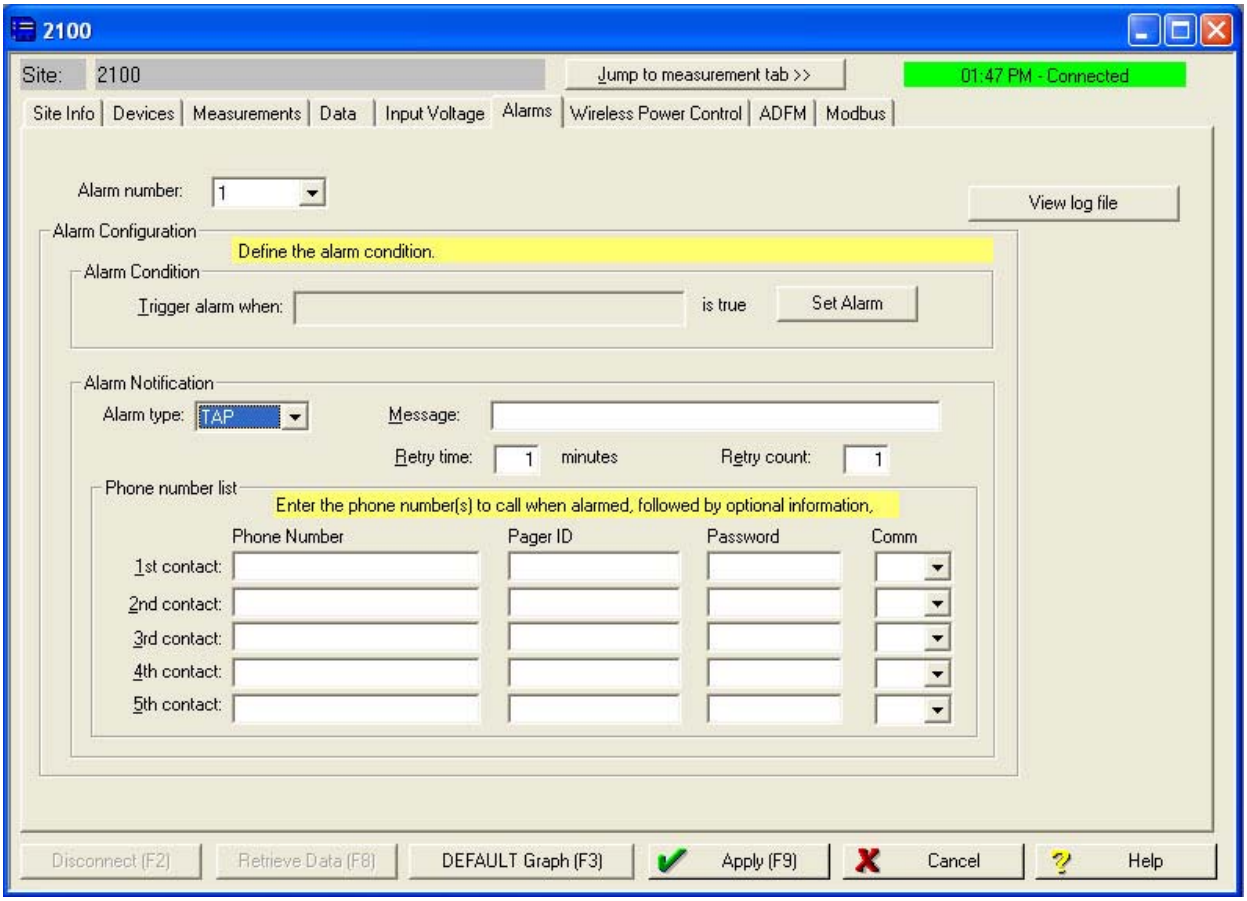


Figure 2-7 Dialout phone numbers and alarm conditions

2. Under Alarm Notification, select the Alarm type (TAP or SMS).
3. In the Phone Number list box, type the contact telephone numbers. These must be valid TAP or SMS access numbers. You must enter at least one number; you can enter as many as five. When an alarm condition is triggered, the system will try dialing each number in the list.
   a. To find this number, and the communications parameter settings, consult with your pager service, or go to **http://avtech.com/Support/TAP/index.htm** or to **http://www.notepage.net/tap-phone-numbers.htm**.

b. Below the heading *TAP dialup* or *TAP Paging Terminal Phone Numbers*, click the letter corresponding with the first letter of the name of your service provider. You will advance to a screen that shows your service provider, the access number, and parameter values (Figure 2-8).

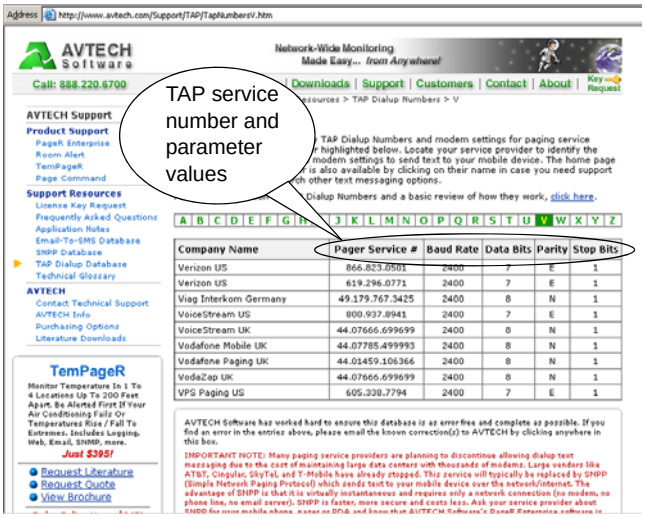


Figure 2-8 TAP Service Parameters

4. For each phone number entered, enter a Pager ID, which is the phone number of the cell phone or pager that will receive the text message. (The ID will come from your pager service.)
5. You have the option of entering a password of up to six characters in length.
6. In the Comm field, select 7E1 or 8N1 for the communications control specification (your pager service has this information).
7. You must enter a message to be sent to the pager. In the field labeled Message, type the outgoing text message (maximum of 32 characters).
8. Under “Alarm condition,” select the retry number and interval, and define the alarm condition using the Equation Builder. Defined alarm conditions will appear on the pull-down list.
9. Click the Apply button or press F9 when you are done, to update the module’s settings.

2.6 Power Conservation for Cellular Modems

If you are using a 2103C or 2103G, you may wish to conserve battery power by setting up a Power Control method using the equation builder. Rather than have the internal modem continuously enabled, you can specify conditions for when it is powered up. To begin configuring the power settings, click the Wireless Power Control tab (Figure 2-9).

> ☑ ***Note***
>
> Power Control applies only to the **internal modem**, not the module itself. However, during the specified periods when the modem is disabled, you will only be able to communicate with the module via direct connection.

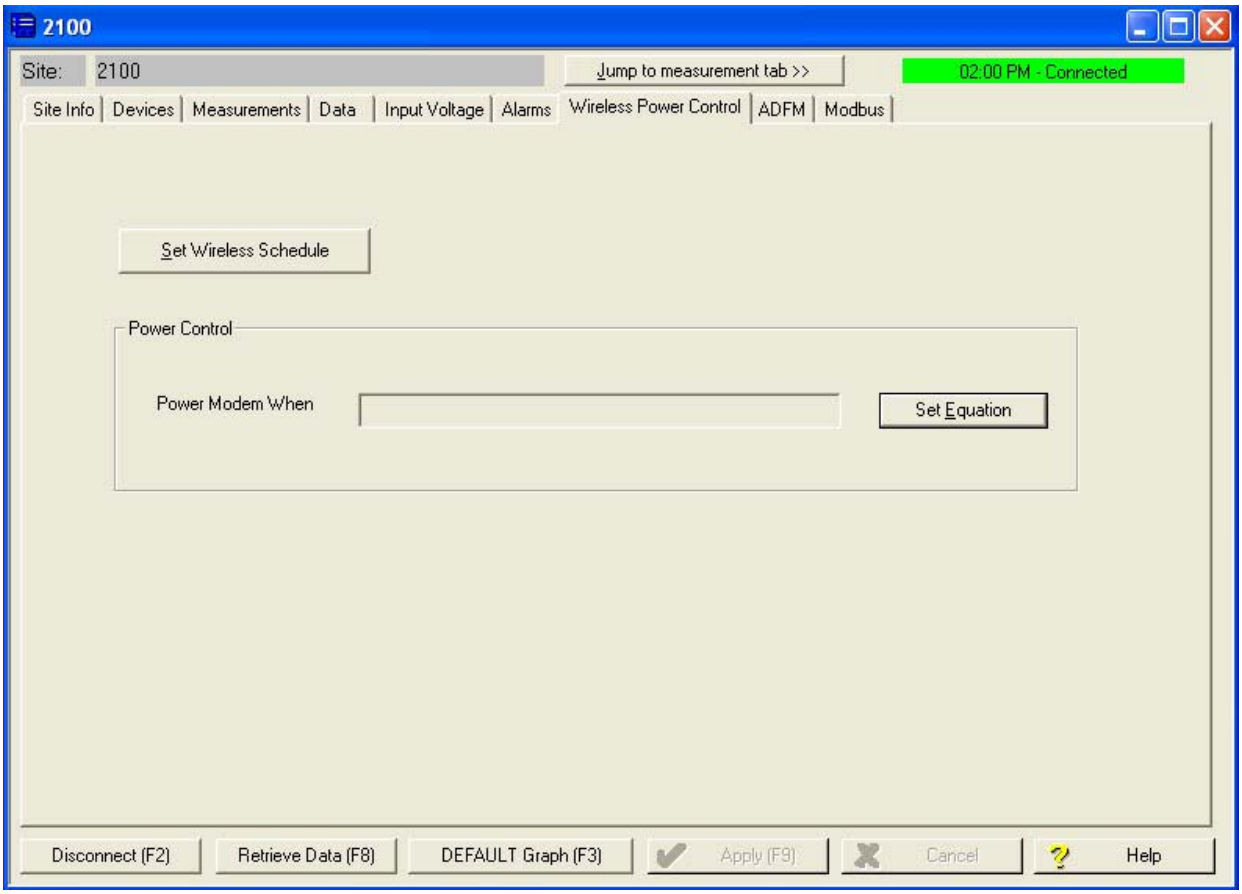


Figure 2-9 Power control window

2.6.1 Equation

The Set Equation button (Figure 2-9) allows you to control the On/Off time of the modem through the use of equations (Figure 2-10). When the conditions of an equation are true, the site will turn the modem on. When conditions are false, the modem is turned off, conserving battery power. To begin building an equation, select a condition from the list. Click Edit Condition to activate the equation building functions.

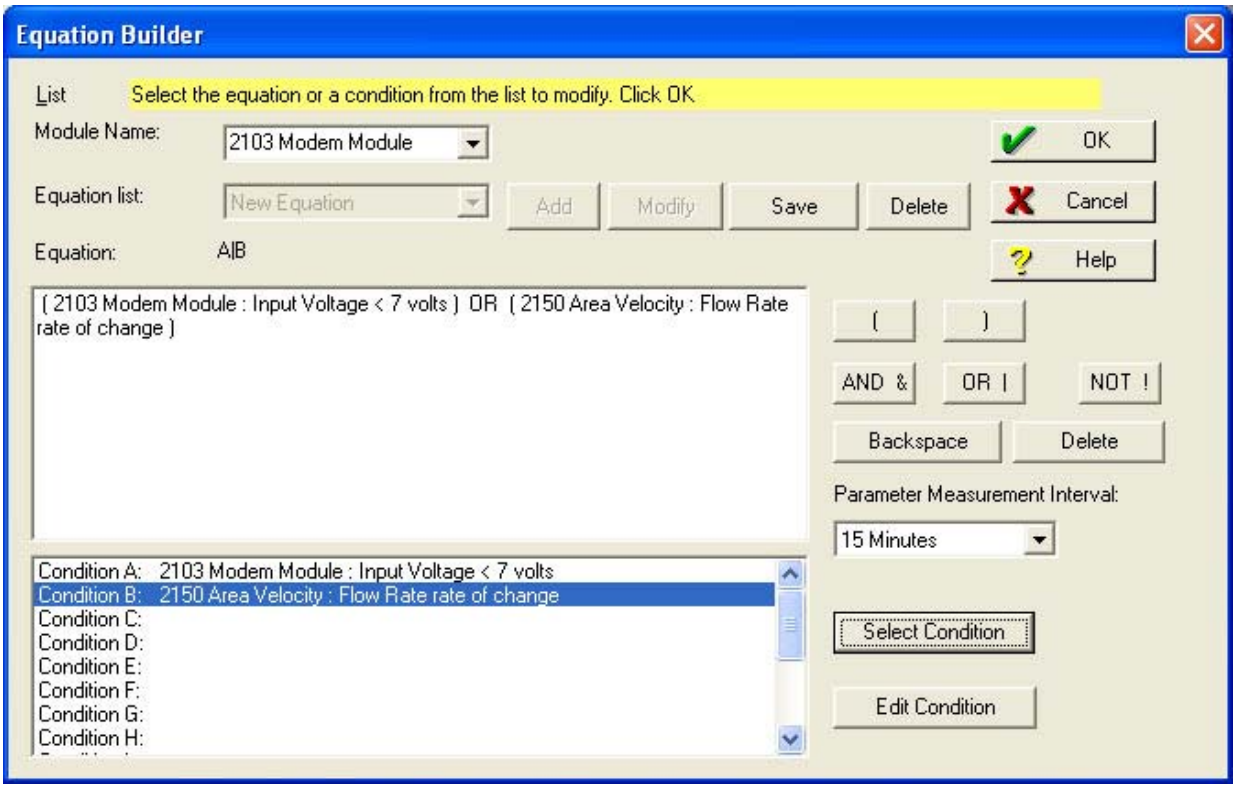


Figure 2-10 Equation builder for power control

2.7 Pushed Data Capability

The 2103 can automatically send data to a designated server running Isco Flowlink Pro software, using 1xRTT packet-switched data transmission (2103C), GPRS packet-switched data transmission (2103G), or a modem listener feature for bridging landline connections (2103). The user-specified primary data transmission interval (5 minutes to 24 hours) can automatically change to a secondary interval when specific site conditions occur at the monitoring site. An Oracle® or Microsoft® SQL database is required to use this feature. Contact the factory for additional information.

To use the data push capability, you need to make sure you are connected to the modem module, and then select the Data tab (Figure 2-11).

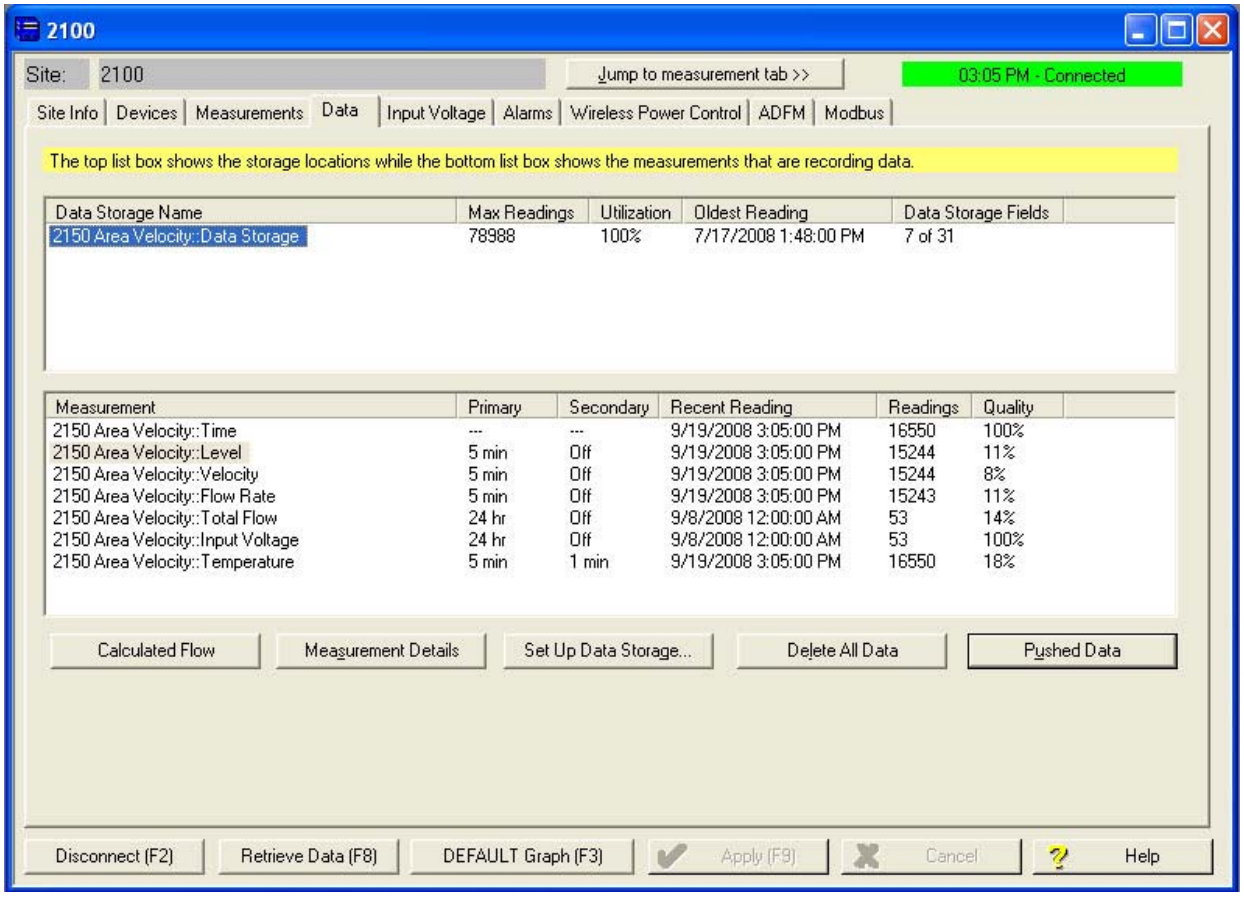


Figure 2-11 Data tab

Click the Pushed Data button to set up a schedule for the data to be pushed to a Flowlink Pro server.

Detailed Flowlink instructions are beyond the scope of this manual. Flowlink's operating instructions are available in a Windows Help format. You can access the Help topics for an active window by clicking its *Help* button or by pressing F1 on your computer's keyboard. You can also access Help topics by selecting Help from the Flowlink menu.

2103 Modem Module

Section 3 2103C Cellular Modem Module

3.1 Overview

The 2103C Modem (part #68-2000-081 with a magnetic mount antenna; part #68-2000-082 with an in-street antenna) is a portable data retrieval unit designed to transmit data from Isco's 2100 Series open channel flow modules.

3.1.1 Data Retrieval

Using a computer running Isco's Flowlink® software, you can call up your monitoring site to configure the flow module settings and retrieve flow data.

Detailed operating instructions are available in Flowlink in a Windows Help format, and in the flow module's Installation and Operation Guide.

3.1.2 Text Messaging

Using CDMA technology, the 2103C is capable of digital text messaging to up to 5 text capable cellular phones or pagers when a programmed alarm condition occurs.

Consult the Flowlink Help files and Installation and Operation Guide for details on programming alarm conditions.

3.1.3 Stacking / Compatibility

The 2103C can be located anywhere within a stack of 2100 Series modules, or used remotely, powered by an Isco 2191 battery module. The 2103C is compatible with Isco's 2150 Area Velocity flow module, 2110 Ultrasonic flow module, 2101 Field Wizard, and 2102 Wireless module.

3.1.4 Cellular Service

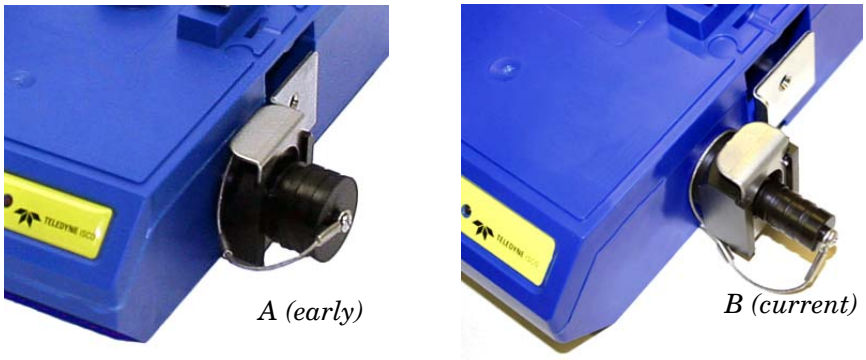
The 2103C only works in a CDMA cellular service area with 1xRTT service. See your local service provider for availability.

3.2 Antenna Options

The 2103C antenna connector design has recently been updated. Operation is exactly the same for both versions.

The two versions of the module are distinguishable from one another by the appearance of the antenna connector. The earlier connector type has slightly different steps for connection to the module. If your module has the larger side connector (Figure 3-1-A, below), follow the instructions in Section 3.3, *Antenna: Early Version*. If your module has the smaller side connector (Figure 3-1-B, below), follow the instructions in Section 3.4, *Antenna: Later Version*.

An adaptor cable is available for connecting early-style antennas to the later module (part #60-5314-891).



A (early) *B (current)*

Figure 3-1 Early and current versions of the 2103C antenna connector

⚠ CAUTION

Never use the antenna for a 2103Ci module with a 2103C module.

3.3 Antenna: Early Version

One of three antenna types is included with your system, specified when ordering: the magnetic mount antenna, the in-street antenna, and the manhole lid-mount antenna.

☑ *Note*

For the transmitter to comply with FCC Maximum Permissible Exposure (MPE) regulations, the antenna must be located a minimum of 30 centimeters (12 inches) from the human body.

☑ *Note*

When any communication connector is not in use, it should always be capped. The cap will seal the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

3.3.1 Magnetic Mount (part #68-2000-032)

This antenna is 3 inches tall and has a 6 foot cable. It is for general use, and is especially desirable when the system is stored within an enclosure.

Figure 3-2 2103C magnetic mount antenna: early version

3.3.2 In-Street (part #68-2000-031)

This antenna is 4 inches in diameter and 1.75 inches tall, with a 10 foot cable. It is used primarily in manhole applications.

The antenna can be buried next to the manhole, in a hole bored into the pavement, at a depth leaving the top of the antenna flush with the street. A connecting hole is drilled through the manhole collar for the antenna's cable. To complete the installation, fill the holes in with cement or asphalt.

Figure 3-3 2103C buried in-street antenna: early version

3.3.3 Manhole Lid-Mount (part #60-5314-779)

This antenna is 6 inches in diameter and 0.705 inches tall (4.575 inches tall with manhole and mounting shank included).

A hole is drilled into the manhole cover to accommodate the 3/4" by 4" shank, then the antenna is inserted, cable first, into the hole and fastened in place. This antenna comes with a special tool for holding it in place while tightening the shank to prevent damage.

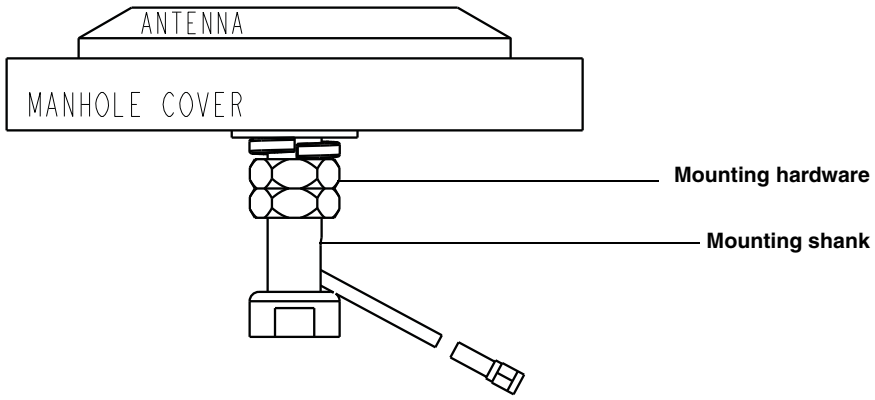


Figure 3-4 2103 Manhole lid-mount antenna: early version

3.3.4 Connecting the Antenna

The antennas are connected to the 2103C using the connector on the right hand side of the module.

The three antenna types use a protective connector shell on the end of the cable to protect the end connector from the elements. On the magnetic mount antenna, this connector shell is installed at the factory. If you order an in-street or manhole lid antenna, the shell is left off to make it easier to install.

When you are ready to connect the in-street antenna to the 2103G modem, you will need to assemble the connector shell onto the end of the cable. The pieces of the connector shell are shown in Figure 3-5. An instruction sheet showing the assembly steps (Isco part #60-2003-506) is shipped with the antenna.

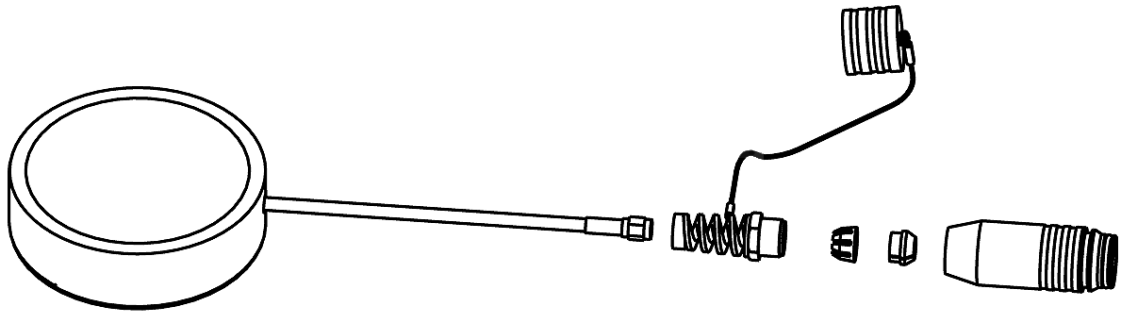


Figure 3-5 Protective connector shell pieces for early antennas

To connect an antenna to the 2103C, twist the protective connector shell to loosen its components. Slide the components down the cable to reveal the gold connector end.

Twist the connector shell to loosen its components.

Slide the components down the cable, and connect the gold connector end to the modem.

Figure 3-6 Connecting an antenna to the 2103C

When the gold SMA connector is tightly attached to the modem, slide the connector shell forward. Press down on the metal latch on the side of the module and push the connector shell into the socket.

Figure 3-7 Antenna connected to the 2103C

3.4 Antenna: Later Version

One of three antenna types is included with your system, specified when ordering: the magnetic mount antenna, the in-street antenna, and the manhole lid-mount antenna.

> **Note**
>
> For the transmitter to comply with FCC Maximum Permissible Exposure (MPE) regulations, the antenna must be located a minimum of 30 centimeters (12 inches) from the human body.

> **Note**
>
> When any communication connector is not in use, it should always be capped. The cap will seal the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

To connect the antenna to the module, simply push the connector into the socket until it clicks. To release, press down on the metal latch on the side of the module and gently pull the antenna connector out of the socket.

3.4.1 Magnetic Mount (part #60-2004-566)

This antenna is 3 inches tall and has a 6 foot cable. It is for general use, and is especially desirable when the system is stored within an enclosure.

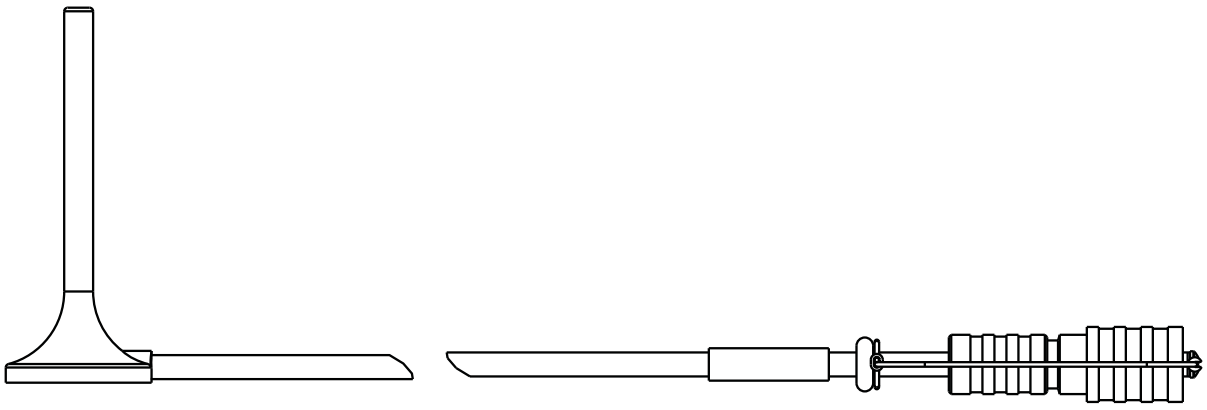


Figure 3-8 2103C magnetic mount antenna: later version

3.4.2 In-Street (part #60-2004-564)

This antenna is 4 inches in diameter and 1.75 inches tall, with a 10 foot cable. It is used primarily in manhole applications.

The antenna can be buried next to the manhole, in a hole bored into the pavement, at a depth leaving the top of the antenna flush with the street. A connecting hole is drilled through the manhole collar for the antenna's cable. To complete the installation, fill the holes in with cement or asphalt.

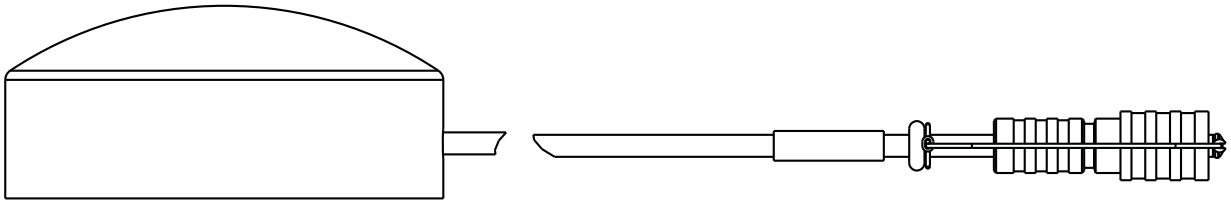


Figure 3-9 2103C buried in-street antenna: later version

3.4.3 Manhole Lid-Mount (part #60-5314-820)

This antenna is 6 inches in diameter and 0.705 inches tall (4.575 inches tall with manhole and mounting shank included).

A hole is drilled into the manhole cover to accommodate the $^{3}/_{4}$" by 4" shank, then the antenna is inserted, cable first, into the hole and fastened in place. This antenna comes with a special tool for holding it in place while tightening the shank to prevent damage.

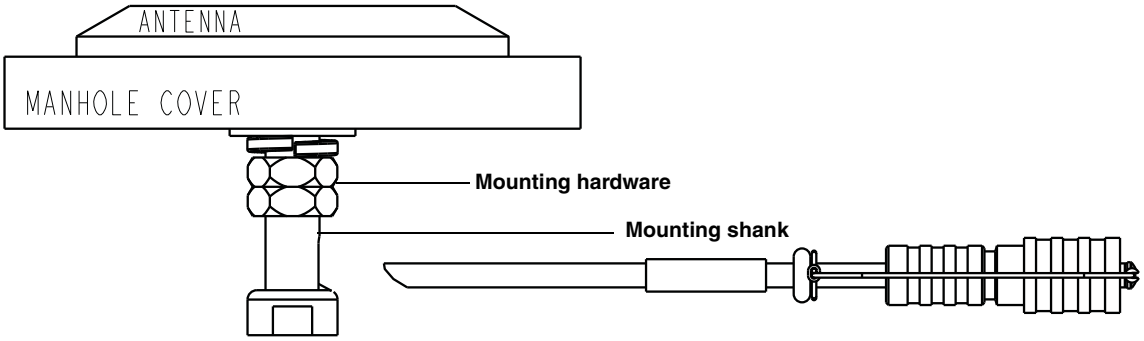


Figure 3-10 2103 Manhole lid-mount antenna: later version

2103 Modem Module

Section 4 2103G Cellular Modem Module

4.1 Overview

The 2103G Modem (part #68-2000-084 with a magnetic mount antenna; part #68-2000-083 with an in-street antenna) is a portable data retrieval unit designed to transmit data from Isco's 2100 Series open channel flow modules.

4.1.1 Data Retrieval

Using a computer running Isco's Flowlink® software, and the appropriate cellular service, you can call up your monitoring site to configure the flow module settings and retrieve flow data.

Detailed operating instructions are available in Flowlink in a Windows Help format, and in the flow module's Installation and Operation Guide.

4.1.2 Text Messaging

Using GSM technology, and with the appropriate SIM card, the 2103G is capable of digital text messaging to up to 5 text capable cellular phones or pagers when a programmed alarm condition occurs.

Consult the Help files and Installation and Operation Guide for details on programming alarm conditions.

4.1.3 Stacking / Compatibility

The 2103G can be located anywhere within a stack of 2100 Series modules, or used remotely, powered by an Isco 2191 battery module. The 2103G is compatible with Isco's 2150 Area Velocity flow module, 2110 Ultrasonic flow module, 2101 Field Wizard, and 2102 Wireless module.

4.2 SIM Card

The data transmission capabilities of the 2103G are dependent upon the type of service plan you have through your cell phone service provider. The service parameters, or provider, can be changed by simply replacing the Subscriber Information Module (SIM) card in your 2103G. Check with your service provider to verify what data transmission technologies are available for your use.

To access the SIM card slot, turn the 2103G module over. On the bottom is a round metal cover that, when unscrewed, provides access to the card (Figure 4-1).

Figure 4-1 Accessing the SIM card on the bottom of the module

The SIM card is held in the slot in the modem with a small switch. To remove or insert the card, the switch must be in the unlocked position (away from the card slot).

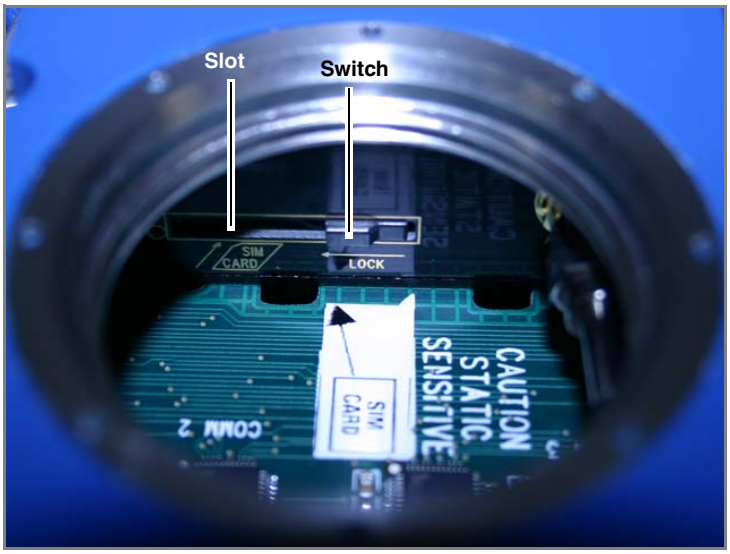


Figure 4-2 SIM card slot and release switch

Inserting the SIM card is made easier by propping the module in a vertical position, as shown below in Figure 4-3. Press the card into the spring-loaded slot until it “clicks” into place.

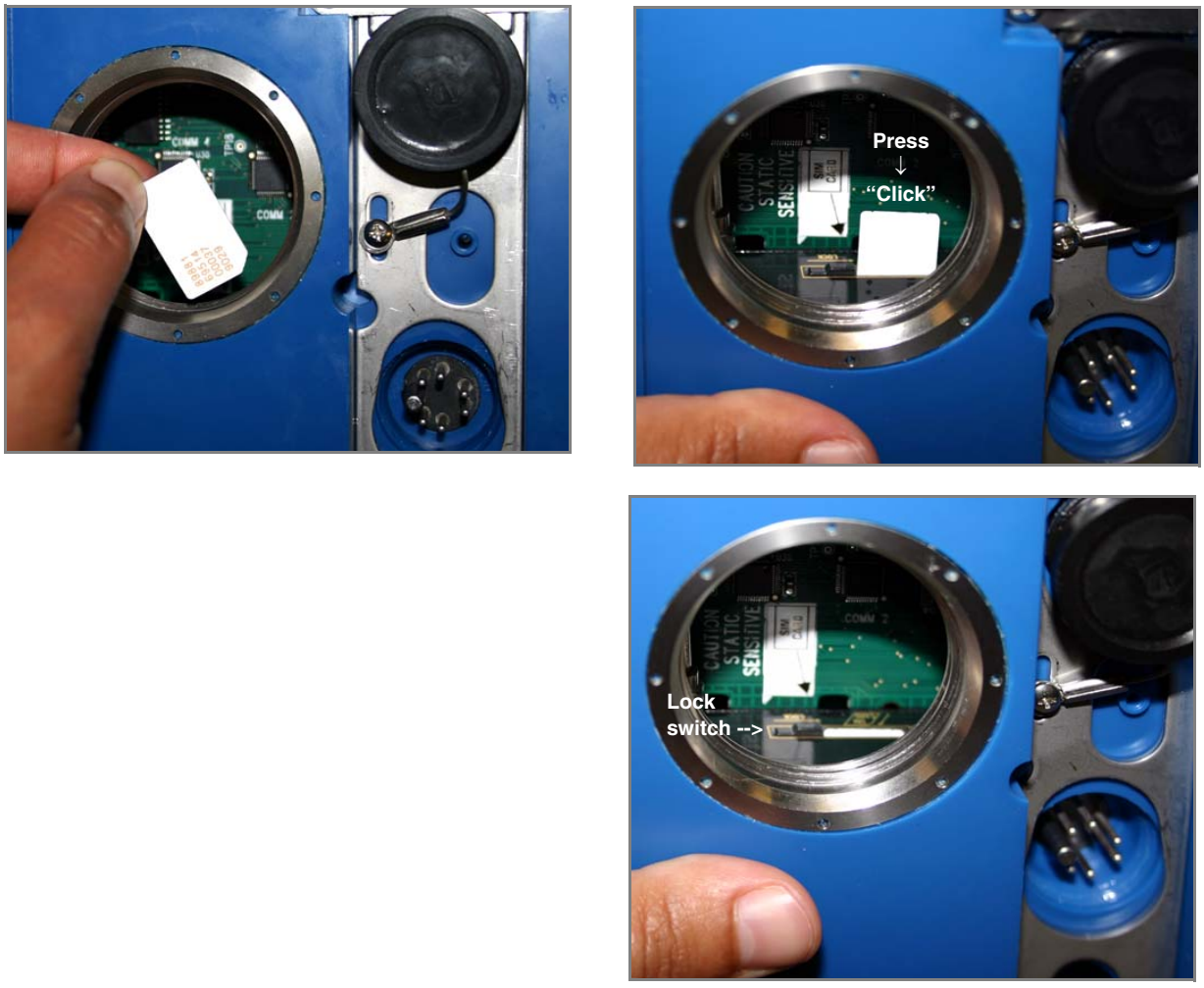


Figure 4-3 Inserting the SIM card into the module

After inserting the SIM card, slide the switch next to the card slot into the locked position to secure the card in place. Then reinstall the metal cover on the bottom of the module.

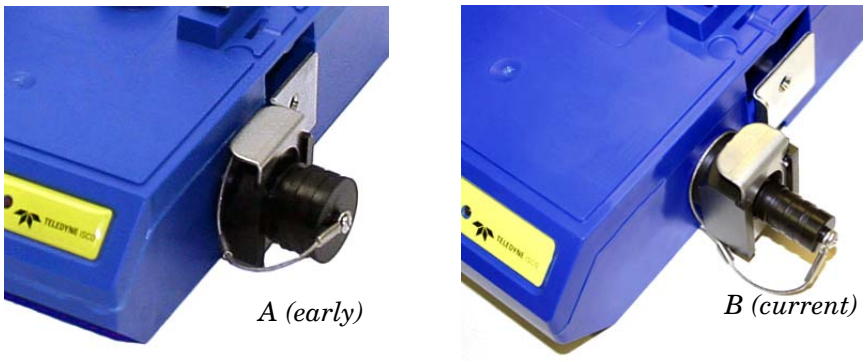
To eject the SIM card, slide the switch away from the card and press the edge of the card so that it “clicks” again.

4.3 Antenna Options

The 2103G antenna connector design has recently been updated. Operation is exactly the same for both versions.

The two versions of the module are distinguishable from one another by the appearance of the antenna connector. The earlier connector type has slightly different steps for connection to the module. If your module has the larger side connector (Figure 4-4-A, below), follow the instructions in Section 4.4, *Antenna: Early Version*. If your module has the smaller side connector (Figure 4-4-B, below), follow the instructions in Section 4.5, *Antenna: Current Version*.

An adaptor cable is available for connecting early-style antennas to the current module (part #60-5314-891).



A (early) *B (current)*

Figure 4-4 Early and current versions of the 2103G antenna connector

4.4 Antenna: Early Version

One of three antenna types is included with your system, specified when ordering: the magnetic mount antenna, the in-street antenna, and the manhole lid-mount antenna.

☑ Note

For the transmitter to comply with FCC Maximum Permissible Exposure (MPE) regulations, the antenna must be located a minimum of 30 centimeters (12 inches) from the human body.

☑ Note

When any communication connector is not in use, it should always be capped. The cap will seal the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

4.4.1 Magnetic Mount (part #68-2000-047)

This antenna is 5 inches tall and has a 6 foot cable. It is for general use, and is especially desirable when the system is stored within an enclosure.

Figure 4-5 2103G magnetic mount antenna: early version

4.4.2 In-Street (part #68-2000-031)

This antenna is 4 inches in diameter and 1.75 inches tall, with a 10 foot cable. It is used primarily in manhole applications.

The antenna can be buried next to the manhole, in a hole bored into the pavement, at a depth leaving the top of the antenna flush with the street. A connecting hole is drilled through the manhole collar for the antenna's cable. To complete the installation, fill the holes in with cement.

Figure 4-6 2103G in-street antenna: early version

4.4.3 Manhole Lid-Mount (part #60-5314-779)

This antenna is 6 inches in diameter and 0.705 inches tall (4.575 inches tall with manhole and mounting shank included).

A hole is drilled into the manhole cover to accommodate the 3/4" by 4" shank, then the antenna is inserted, cable first, into the hole and fastened in place. This antenna requires a special tool for holding it in place while tightening the shank to prevent damage.

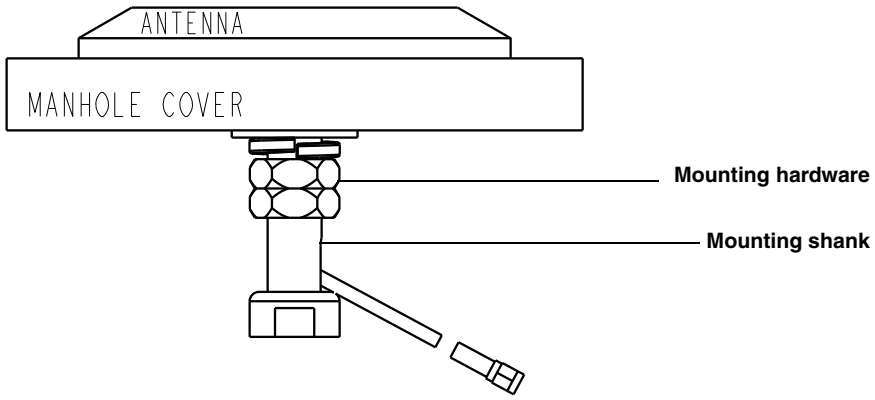


Figure 4-7 2103G Manhole lid-mount antenna: early version

4.4.4 Connecting the Antenna

The antennas are connected to the 2103G using the connector on the right hand side of the module.

The three antenna types use a protective connector shell on the end of the cable to protect the end connector from the elements. On the magnetic mount antenna, this connector shell is installed at the factory. If you order an in-street or mahole lid antenna, the shell is left off to make it easier to install.

When you are ready to connect the in-street antenna to the 2103G modem, you will need to assemble the connector shell onto the end of the cable. The pieces of the connector shell are shown in Figure 4-8. An instruction sheet (Isco part #60-2003-506) is shipped with the antenna, and shows you the assembly steps.

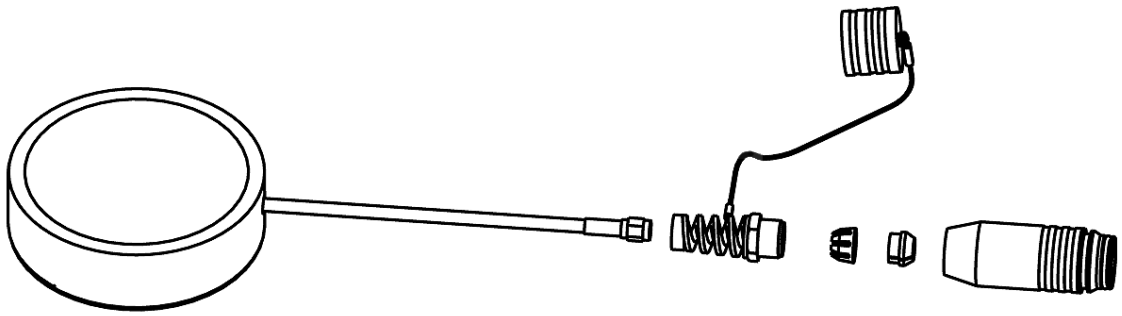


Figure 4-8 Protective connector shell pieces for early antennas

To connect an antenna to the 2103G, twist the protective connector shell (Figure 4-9) to loosen its components. Slide the components down the cable to reveal the gold connector end.

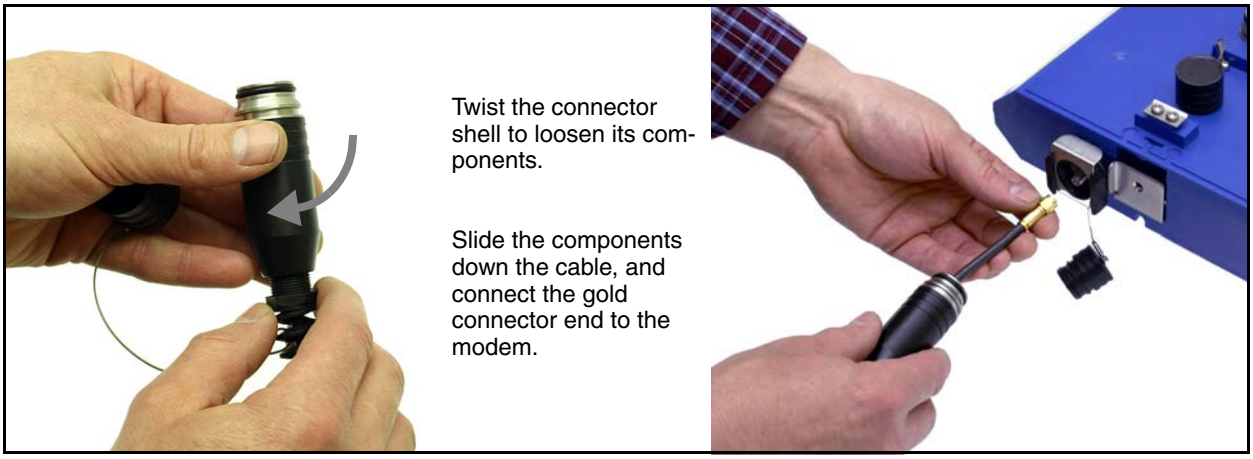


Figure 4-9 Connecting an antenna to the 2103G

When the gold SMA connector is tightly attached to the modem, slide the connector shell forward. Press down on the metal latch on the side of the modem and push the connector shell onto the modem, as shown in Figure4-10.

Figure 4-10 Antenna connected to the 2103G modem.

☑ Note

When any communication connector is not in use, it should be capped. The cap will seal the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

☑ Note

For the transmitter to comply with FCC Maximum Permissible Exposure (MPE) regulations, the antenna needs to be located a minimum of 30 centimeters (12 inches) from the human body.

4.5 Antenna: Current Version

One of three antenna types is included with your system, specified when ordering: the magnetic mount antenna, the in-street antenna, and the manhole lid-mount antenna.

> ☑ ***Note***
>
> For the transmitter to comply with FCC Maximum Permissible Exposure (MPE) regulations, the antenna must be located a minimum of 30 centimeters (12 inches) from the human body.

> ☑ ***Note***
>
> When any communication connector is not in use, it should always be capped. The cap will seal the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

To connect the antenna to the module, simply push the connector into the socket until it clicks. To release, press down on the metal latch on the side of the module and gently pull the antenna connector out of the socket.

4.5.1 Magnetic Mount (part #60-2004-565)

This antenna is 3 inches tall and has a 6 foot cable. It is for general use, and is especially desirable when the system is stored within an enclosure.

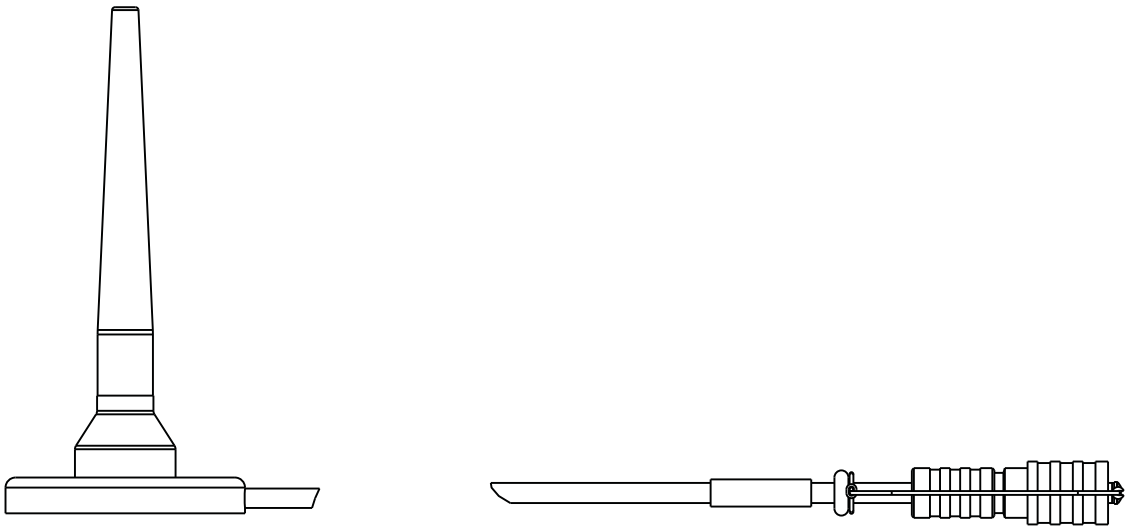


Figure 4-11 2103G magnetic mount antenna: current version

4.5.2 In-Street (part #60-2004-564)

This antenna is 4 inches in diameter and 1.75 inches tall, with a 10 foot cable. It is used primarily in manhole applications.

The antenna can be buried next to the manhole, in a hole bored into the pavement, at a depth leaving the top of the antenna flush with the street. A connecting hole is drilled through the manhole collar for the antenna's cable. To complete the installation, fill the holes in with cement or asphalt.

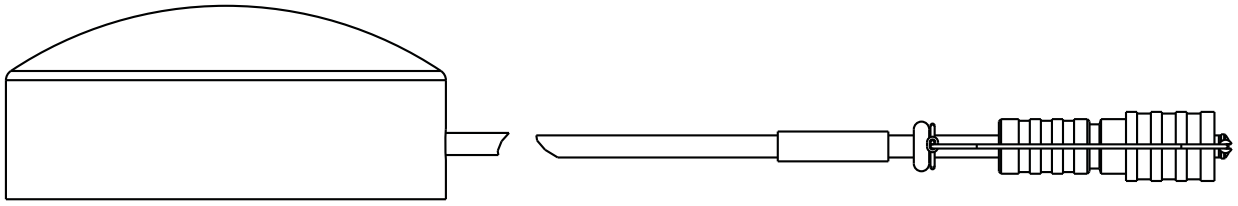


Figure 4-12 2103G buried in-street antenna: current version

4.5.3 Manhole Lid-Mount (part #60-5314-820)

This antenna is 6 inches in diameter and 0.705 inches tall (4.575 inches tall with manhole and mounting shank included).

A hole is drilled into the manhole cover to accommodate the 3/4" by 4" shank, then the antenna is inserted, cable first, into the hole and fastened in place. This antenna comes with a special tool for holding it in place while tightening the shank to prevent damage.

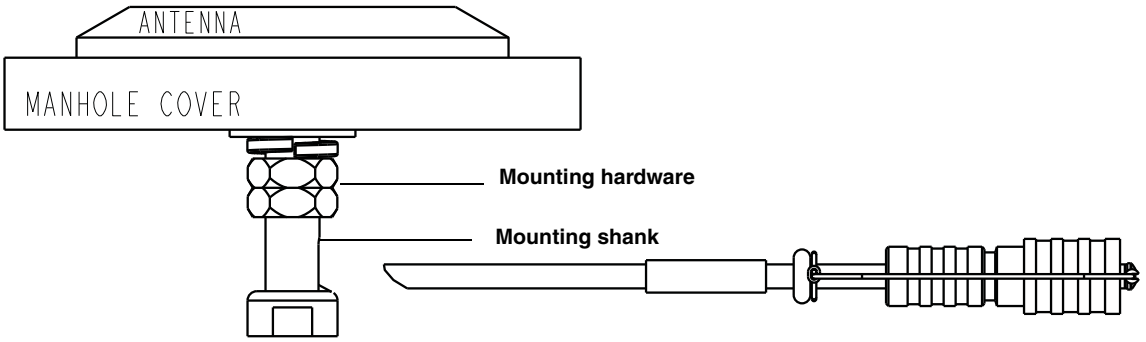


Figure 4-13 2103G Manhole lid-mount antenna

4.6 Setting Up The Access Point Name

You may need to set up the access point that your cellular service uses.

> ☑ ***Note***
>
> This section only applies to GPRS operation, and requires the appropriate cellular service and SIM card.

The access point information is available from your service provider.

1. From your Windows desktop, start the HyperTerminal program (located under Accessories, Communication).
2. Make sure the 2103G is powered on, and that HyperTerminal is disconnected. Select the COM port you will direct connect to.
3. Configure the COM port to: **38400 bps, 8 data bits, no parity, no stop bits, no flow control**. Click OK.
4. Click on the phone icon to connect, and enter 3 or 4 question marks (**?**).
5. At the **>** prompt, enter **sp** and press Return.
6. At the **>** prompt, enter **18** and press Return.
7. At the **DPUSH>** prompt, enter **apn** and press Return. This will display the current setting for the access point name.
8. If you need to change the access point name, at the > prompt, enter **apn *"name of access point"*** and press Return.
9. You will be informed that the phone network information has been updated.
10. Cycle power to the modules.

There are several commands that can be used in HyperTerminal. The **>dcfg** command will show what IP address you should be using. The **>dsp** command shows the network type (GSM) and the access point name.

2103 Modem Module

Section 5 Modbus Protocol

Sections 5.1 through 5.5 give an overview of the basic capabilities and operation of Modbus protocol as it applies to Isco 2100 Series flow modules.

For a Glossary of Terms and Common Acronyms, see sections 5.4 and 5.5.

For Modbus technical specifications, turn to section 5.6.

5.1 Introduction

Modbus is a simple command/response mechanism to read from and write to specific memory locations called *registers*. A register is a holding place for a piece of digital information within the equipment. There are three standard protocols for Modbus: Modbus RTU, Modbus TCP/IP, and Modbus ASCII. The Isco 2100 Series devices use Modbus ASCII protocol, the method discussed in this manual. Modbus ASCII has more liberal communication timing requirements. Modbus communication for the Isco 2100 Series provides a standard protocol that can be used to retrieve real-time data from a single module or stack of modules at a site, or multiple sites, over a wide area. The data can be sent to a central computer for display, data collection, or process control.

Modbus implementation is independent of Flowlink and cannot alter the Flowlink-programmed configuration of the module. Modbus cannot be used to retrieve historical data from a module's memory.

Due to the wide variety of configurations that can be made with Modbus, it is impossible to cover every usable application. This section will discuss the overall capabilities and operation of Modbus.

5.2 Operation

There are many standard, third party Modbus drivers and OPC servers that may be used to link a remote Modbus device, such as a 2100 Series module, to SCADA or process control software, such as Wonderware™ or Intellution™. The OPC server communicates with the remote instrumentation and accesses registers. The definition of what information is contained and where (the register number, or address) is decided by the manufacturer (Teledyne Isco).

In a 2100 module, the registers hold, but are not limited to, the current real-time value of the meter's level, velocity, flow, input voltage, temperature, and total flow readings, stored in specified register locations. A list of the 2100 register addresses, and what parameters are held where, is available in section 5.6.

By accessing these registers you can obtain the current value of whatever parameter you desire. The reading(s) can then be displayed or stored wherever you designate as a destination; for example, a process control computer.

> **Note**
>
> Level, flow, velocity, and temperature data is stored in metric units only.

Not all registers are limited to read-only data storage. You can also use some registers for control purposes. For example, by writing a "1" value to register 24 ("Identify Module" register), you will tell a 2100 module to light the LED on the front of the module.

5.2.1 Establishing Communication

There are several different communications protocols supported in the 2100 series that require auto-baud rate detection. Because of this, each time a modbus connection is made, the module uses a polling mechanism to repeatedly send a command until a response is received. It may take up to 20 command retries before the module has identified the baud rate and a response is received.

5.2.2 Module Addressing

When connecting to a site via a Modbus OPC server, you use a dedicated line of communication to that module or stack from the OPC server, which can be a dedicated communications cable (direct connection) or a dedicated phone number (modem).

When you are using a direct connection, you are dedicating a specified COM port on the computer, and that COM port determines the site to which you are connecting.

When you are using a modem, the dedicated line is defined by the site's phone number.

If you connect more than one 2100 Series module at a site, the Modbus OPC server, while using the shared communication line for all of the modules within the network, must have some way to differentiate between the modules. When sending a command to a specific module, the command has an address field. This allows the server software to talk to, as well as control, the specified module, while ignoring other modules in the same stack or site.

Each module capable of Modbus Protocol communication will automatically create its own specific ASCII address within the site, using:

- The model numbers of the modules
- The user-defined module names

5.3 Configurations

A variety of configurations can be made with Modbus, either through direct connection or through a modem.

In the example shown in Figure 5-1, you are direct-connecting a server PC to two individual 2100 sites through Modbus, using the COM ports on the OPC Server, which are directly connected to the remote sites.

Connection to the module is made through the RS-232 communication port on the top of the module.

> **Note**
>
> For low power operation, we recommend connecting the module(s) to the computer using the straight-through cable (Isco part number 60-5314-529), which consumes less power, instead of our standard interrogation cable.

In Figure 5-1, the OPC Server PC must have two COM ports. Modbus requires one COM port each, for direct connection of each 2150.

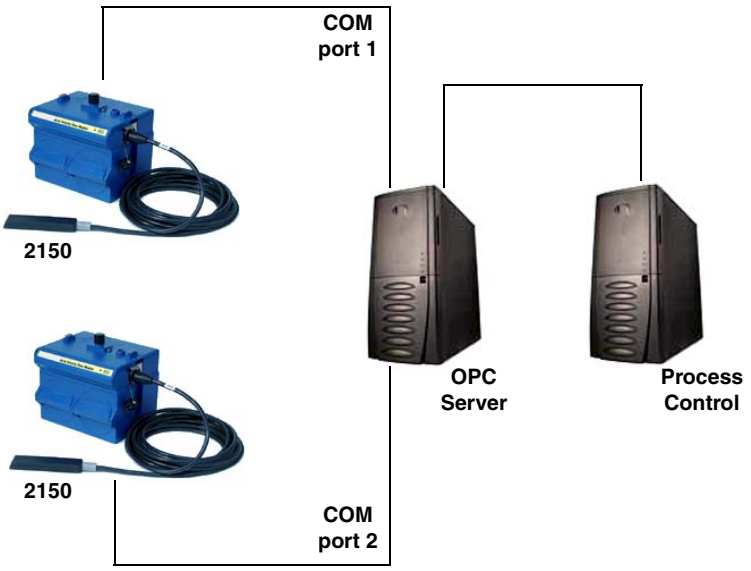


Figure 5-1 Configuration example

The operation sequence for the example above can be summarized in the following steps:

2150:

1. 2150s take readings from probes.
2. 2150s store readings (level, velocity, flow rate, etc.) in their specified registers.

Process Control:

3. The user requests data through Process Control.
4. Process Control asks the OPC server to gather information.

5. OPC connects to the 2150 stack through the cable (direct connection), takes register data from the specified 2150, and populates the OPC server's holding index.
6. Process Control takes data from the OPC server's holding index and gives data to the user.

Note that Process Control can be either manual or automated in this example, and that the OPC server and Process Control may be located physically on the same computer.

5.4 Glossary of Terms

ASCII – Short for American Standard Code for Information Interchange, ASCII is a code that represents English characters with numbers. Most computers represent text with ASCII code, making it possible for one computer or device to share data with another.

2100 modules support Modbus ASCII protocol.

Dedicated Line – A telecommunications path reserved for communication between two specified points and not shared among multiple points.

Modbus Protocol – Modbus Protocol is a messaging structure used to establish master-slave/client server communications between intelligent devices. Modbus is a simple command/response mechanism to read from and write to registers.

OPC – OPC (OLE for Process Control) means open connectivity via open (free for use) standards. It is a series of software standards specifications that fill a need in automation (like printer drivers did for Windows), acting as a translator for data transmission and process control.

The specification defines a standard set of objects, interfaces, and methods for use in process control and manufacturing automation applications to facilitate interoperability. There are hundreds of OPC Data Access servers and clients.

Registers – Registers are locations in memory that have specific data stored for retrieval or are used for control functions. A register is a holding place for a piece of digital information within the equipment. The definition of what is contained and where (the registry number, or address) is decided by the manufacturer (in this case Teledyne Isco).

SCADA – SCADA (Supervisory Control And Data Acquisition) is a computer system for gathering and analyzing real-time data. SCADA systems are used to monitor and control plant operation, or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining, and transportation.

The SCADA system transfers the information (for example, where a leak has occurred in a pipeline), back to a central site, alerting the home station of the leak, performing necessary analysis and control (such as determining if the leak is critical), and displaying the information in a logical and organized manner.

SCADA systems can be relatively simple, such as one that monitors the environmental conditions of a small office building, or very complex, such as a system that monitors all the activity in a nuclear power plant or a municipal water system.

5.5 Common Acronyms

ASCII – American Standard Code for Information Interchange

DCS – Distributed Control Systems

MTU – Master Terminal Unit

OPC – Object Linking and Embedding (OLE) for Process Control

PLC – Programmable Logic Controller

RTU – Remote Terminal Unit

SCADA – Supervisory Control And Data Acquisition

TCP/IP – Transmission Control Protocol/Internet Protocol

5.6 Register Specifications

All numbers in the Modbus registers are stored most significant byte first. If the polling device has a byte ordering of least significant byte first (an Intel-based PC, for example), the bytes will need to be reversed after they are received.

The Modbus ASCII address is used to index the data by modules.

Modbus ASCII address 1 contains information related to the site. The first register contains a 16-bit integer count of the number of modules that have data to report. The maximum number of modules that can be supported is 4.

Modbus ASCII addresses 2 through the number of the module in the stack (N) minus 1 contain data from the individual modules.

The Modbus ASCII addresses will be sorted by the model number, and then by module name, which is entered by the user through Flowlink. This allows the user to control the ordering of the addresses and easily predict what data will be in specific registers.

Every measured parameter has a corresponding status and measurement time that are updated with each measurement.

The maximum number of supported measurements from all modules in the system is 28.

The Modbus registers are assigned within 30 seconds after the 2100 module is powered up. To conserve power for the users who do not use Modbus communications, no Modbus registers will be updated with sensor readings until a Modbus master communicates with the 2100 module.

The register definitions for the Site Information device (Modbus ASCII address 1) are in Table 5-1 below:

Table 5-1 Modbus ASCII Address 1 Register Definitions

Register Number(s)	Name	Data type	Units	Read/Write
1	Number of module (N) (1-4)	16 bit integer	None	Read
2-20	Site name	38-byte string	None	Read

The register definitions for the individual modules (Modbus ASCII addresses 2+(N-1)) are in Table 5-2 below:

Table 5-2 Modbus ASCII Address 2+(N-1) Register Definitions

Register Number(s)	Name	Data Type	Units	Read/Write
1-4	Model number	8-byte string	None	Read
5-23	Module name	38-byte string	None	Read
24[a]	Identify module	16 bit integer	None	Read/Write
25[b]	Take reading flag	16 bit integer	None	Read/Write
26[c]	Update interval	16 bit integer	Seconds	Read/Write
27[d]	Active flag 1	16 bit field	None	Read
28	Active flag 2	16 bit field	None	Read
29	Active flag 3	16 bit field	None	Read
30	Active flag 4	16 bit field	None	Read
40,41	Level	4-byte float	Meters	Read
42	Level status code[e]	16-bit integer		Read
43-48	Level time record	Time[f]		Read
55,56	Velocity	4-byte float	Meters/second	Read
57	Velocity status code	16-bit integer		Read
58-63	Velocity time record	Time		Read
70,71	Flow	4-byte float	Cubic Meters/sec	Read
72	Flow status code	16-bit integer		Read
73-78	Flow time record	Time		Read
85,86	Flow 1	4-byte float	Cubic Meters/sec	Read
87	Flow 1 status code	16-bit integer		Read
88-93	Flow 1 time record	Time		Read
100,101	Volume	4-byte float	Cubic Meters	Read
102	Volume status code	16-bit integer		Read
103-108	Volume time record	Time		Read
115,116	Volume 1	4-byte float	Cubic Meters	Read

Table 5-2 Modbus ASCII Address 2+(N-1) Register Definitions (Continued)

Register Number(s)	Name	Data Type	Units	Read/Write
117	Volume 1 status code	16-bit integer		Read
118-123	Volume 1 time record	Time		Read
130,131	Voltage	4-byte float	Volts	Read
132	Voltage status code	16-bit integer		Read
133-138	Voltage time record	Time		Read
145,146	Temperature	4-byte float	Degrees Celsius	Read
147	Temperature status code	16-bit integer		Read
148-153	Temperature time record	Time		Read
160,161	Internal Temp	4-byte float	Degrees Celsius	Read
162	Internal Temp status code	16-bit integer		Read
163-168	Internal Temp time record	Time		Read
175,176	Analog channel 1	4-byte float	0-100 percent	Read
177	Analog channel 1 status code	16-bit integer		Read
178-183	Analog channel 1 time record	Time		Read
190,191	Analog channel 2	4-byte float	0-100 percent	Read
192	Analog channel 2 status code	16-bit integer		Read
193-198	Analog channel 2 time Record	Time		Read
205,206	Analog channel 3	4-byte float	0-100 percent	Read
207	Analog channel 3 status code	16-bit integer		Read
208-213	Analog channel 3 time record	Time		Read
220,221	Analog channel 4	4-byte float	0-100 percent	Read
222	Analog channel 4 status code	16-bit integer		Read
223-228	Analog channel 4 time record	Time		Read
235,236	Analog channel 5	4-byte float	0-100 percent	Read
237	Analog channel 5 status code	16-bit integer		Read
238-243	Analog channel 5 time record	Time		Read
250,251	Analog channel 6	4-byte float	0-100 percent	Read
252	Analog channel 6 status code	16-bit integer		Read
253-258	Analog channel 6 time record	Time		Read
265,266	Analog channel 7	4-byte float	0-100 percent	Read
267	Analog channel 7 status code	16-bit integer		Read
268-273	Analog channel 7 time record	Time		Read
280,281	Analog channel 8	4-byte float	0-100 percent	Read
282	Analog channel 8 status code	16-bit integer		Read
283-288	Analog channel 8 time record	Time		Read
1765, 1766	Signal strength[g]	4-byte float	0-100 percent	Read

Table 5-2 Modbus ASCII Address 2+(N-1) Register Definitions (Continued)

Register Number(s)	Name	Data Type	Units	Read/Write
1767	Signal strength status code	16-bit integer		Read
1768-1779	Signal strength time record	Time		Read
1780, 1781	Spectrum strength[g]	4-byte float	0-100 percent	Read
1782	Spectrum strength status code	16-bit integer		Read
1783-1794	Spectrum strength time record	Time		Read
1795, 1796	Spectrum ratio[g]	4-byte float	0-100 percent	Read
1797	Spectrum ratio status code	16-bit integer		Read
1798-1809	Spectrum ratio time record	Time		Read

a. A write to the Identify module register will cause the module to perform the identify operation which may be a steady LED for a few seconds or a beep in the Field Wizard.

b. Setting the Take Reading flag to 1 will cause the module to update the registers with current data readings. It will be set to zero when the readings have all been updated. This may be used to initiate readings and poll for when they are ready to be read. It may take up to 50 seconds to update all the readings, depending upon the flow conditions. Setting the Take Reading flag to 2 causes an automatic, 15 second update of readings when a Modbus master is polling the 2100.

c. The Update Interval specifies an interval in seconds that the registers are automatically updated. It defaults to zero, which indicates that no automatic updating will occur.

d. The Active Flag (1-4) bit fields specify what fields/registers are active in the list. This provides support for a maximum of 64 fields. For example, if bit 0 of register 27 is set, the Level (registers 40,41) is active. If bit 1 of register 27 is set, then the Velocity (registers 55,56) is active. If bit 0 of register 28 is set, the Analog channel 7 (registers 265,266) is active.

e. A non-zero status code indicates a measurement problem.

f. Time is represented in a series of registers: Order is from lowest address to highest - Seconds (0-59), Minutes (0-59), Hours (0-23), Days (1-31), Month (1-12) and Year (1977-2099).

g. Optional software feature. Contact Teledyne Isco to order enable code for the module used for communication.

Table 5-3 2100 Measurement Parameters by Model Number*

2103, 2103c/g, 2105, 2105c/g	2108	2110	2150, 2151, 2151P
Voltage	Analog channel 1	Level	Level
	Analog channel 2	Flow	Velocity
	Analog channel 3	Volume	Flow
		Voltage	Flow 1
		Temperature	Volume
			Volume 1
			Voltage
			Temperature
			Signal strength
			Spectrum strength
			Spectrum ratio

*Single module only; does not include any additional connected devices. Subject to change.

2103 Modem Module

Section 6 Maintenance

6.1 Maintenance Overview

This section explains the maintenance requirements of the 2103 Modem Module.

The 2103 is designed to perform reliably in adverse conditions with a minimal amount of routine service requirements. To keep your system working properly, you should check the desiccant and channel conditions at regular intervals.

Maintenance intervals are affected by many variables. Humidity levels obviously affect the service life of the desiccant, and the amount of debris in the stream can drastically alter the channel conditions.

Experience is often the best tool to use when establishing minimum maintenance intervals for your system. Until you have gained an understanding of the AV Module's operation under differing environmental conditions, a weekly maintenance interval is recommended.

6.1.1 Cleaning

The 2103 Module case may be cleaned using a soft cloth, warm water, and a mild detergent. Do not use an abrasive cleanser, or you might scratch the surface of the case.

Before cleaning, make sure that all the protective connector caps are in place to avoid damage to any of the connectors. You should also ensure that no water or cleanser enters the desiccant unit.

6.2 Maintenance Kit

Some of the parts mentioned in the *Maintenance* section of this manual are available in a maintenance kit.

Kit number 60-2009-004 contains three O-rings for the communication connectors, silicone lubricant to apply to the O-rings, a desiccant assembly, and a container of silica gel desiccant. A maintenance instruction sheet is included with the kit.

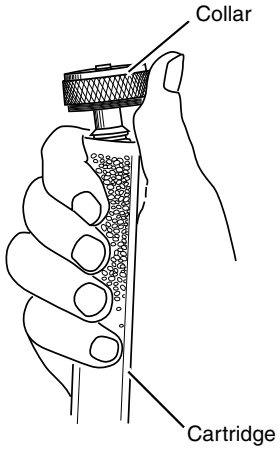
You can order the kit by calling Teledyne Isco's Customer Service Department.

6.3 Desiccant

The 2103 Modem uses desiccant to protect the internal components from moisture damage. The cartridge is filled with indicating silica gel, which is blue or yellow when dry. As the desiccant becomes saturated, the color changes from blue to pink, or from yellow to green. Replace the desiccant before the entire length of the cartridge turns pink or green.

6.3.1 Replacing the Desiccant

The desiccant is contained in a cartridge located on the left side of the 2103 Modem. To remove the cartridge, unscrew the collar and slide the cartridge out of the 2103 Modem. The clear tube reveals the silica gel desiccant inside.



To replace the silica gel desiccant:

1. Hold the cartridge upright with the collar at the top.
2. As shown in the margin, push the collar off the cartridge.
3. Empty the saturated silica gel beads or granules.
4. Fill the tube with new (Isco P/N 099-0011-03) or reactivated (see section 3.3.2) silica gel desiccant.
5. Press the collar onto the tube.
6. Slide the cartridge into the 2103 Modem. Tighten the collar to seal the cartridge in place.

6.3.2 Reactivating the Desiccant

Silica gel beads and granules of desiccant can be reactivated.

⚠ CAUTION

Desiccant may produce irritating fumes when heated. Observe the following precautions:

- Use a vented oven in a well ventilated room.
- Do not remain in the room while the regeneration is taking place.
- Use the recommended temperature. Avoid heating the desiccant at higher than recommended temperatures.

There is the potential of irritating fumes coming from the desiccant during reactivation. Because of this, we urge you to use caution, and to heat the desiccant in a well ventilated room. Material Safety Data Sheets are in the back of this manual.

The desiccant's ability to remove moisture may lessen with each saturation/reactivation cycle, resulting in a need for more frequent service. After several cycles, the desiccant may no longer be effective as it saturates too quickly. At this point, replace the desiccant.

Silica gel

To reactivate the silica gel desiccant, pour the spent desiccant into a heat resistant container. Never heat the cartridge assembly; it will melt. Heat the silica gel in a *vented convection oven* at 212° to 350°F (100° to 175°C) for two to three hours, or until the blue or yellow color returns. Allow the desiccant to cool and store it in an airtight container until ready for use.

6.4 Hydrophobic Filter

If the 2103 is in a humid location or submerged, a hydrophobic filter prevents water from entering the desiccant cartridge and reference line. Any amount of water will plug the filter and it must be rinsed with clean water and allowed to dry, or replaced so that the case can be reliably ventilated.

Remove the hydrophobic filter with a 5⁄8" or 16mm socket. Gently screw in the replacement filter (Isco part #209-0093-93).

If the hydrophobic filter frequently requires replacement, consider relocating the modules so that they are better protected.

6.5 O-Rings

The communication connectors on the top and bottom of the 2103 Modem contain O-rings that need periodic lubrication and replacement. The maintenance kit described in section 3.2 contains O-rings and silicone lubricant.

Whenever you replace the O-rings, or have removed them from the connectors for some reason, you should lubricate the O-rings by applying lubricant around the circumference of the ring.

> ☑ ***Note***
>
> Do not use petroleum-based lubricants. Petroleum-based lubricants will cause the O-ring to swell and eventually deteriorate. Aerosol silicone lubricant sprays often use petroleum based propellants. If you are using an aerosol spray, allow a few minutes for the propellant to evaporate before proceeding.

6.6 How to Obtain Service

The internal components of the 2103 Modem are not user-serviceable. The case is completely sealed to protect the internal components. To repair the unit, the case must be broken open and replaced. If you think your module requires repair, contact Isco's Technical Service Department.

Teledyne Isco
Technical Service Department
P.O. Box 82531
Lincoln, NE 68501
866-298-6174 or 402-464-0231
FAX: 402-465-3001
e-mail:
IscoService@teledyne.com

Corresponding with a Teledyne Isco Technical Service Representative can often resolve the problem without the need to return the item. If the difficulty cannot be resolved you will be issued a Return Authorization Number (RAN) and information on returning it to the factory.

2103 Modem Module

Appendix A Replacement Parts

A.1 Replacement Parts

Replacement parts are called out in the following pages. Refer to the call-out in the adjacent table to determine the part number for the item.

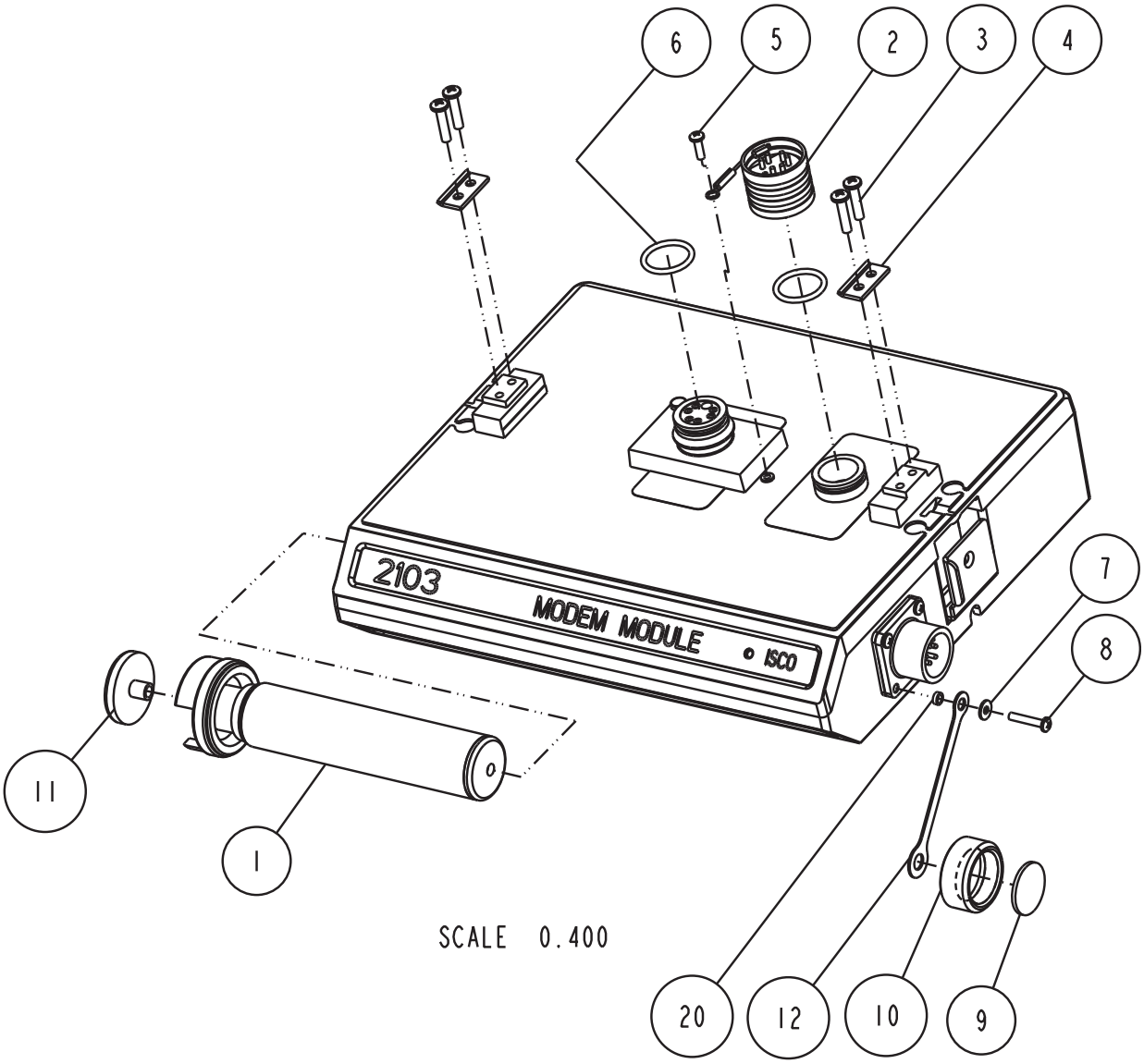
Replacement parts can be purchased by contacting Teledyne Isco's Customer Service Department.

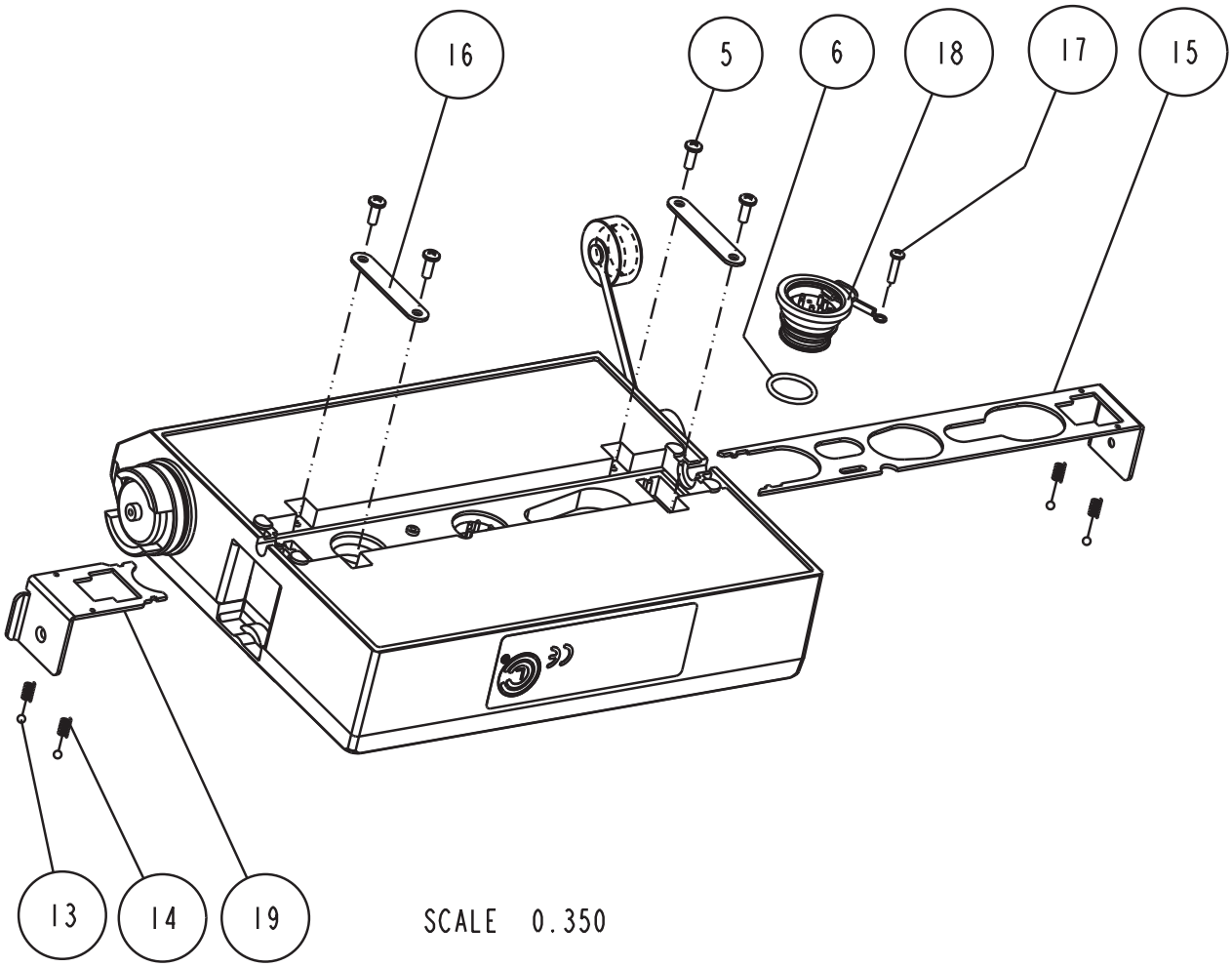
Teledyne Isco
Customer Service Department
P.O. Box 82531
Lincoln, NE 68501 USA

Phone: (800) 228-4373
(402) 464-0231
FAX: (402) 465-3022

E-mail: IscoInfo@teledyne.com

A.1.1 2103 Modem Module




16
5
6
18
17
15
13
14
19
SCALE 0.350

602002154

REPLACEMENT PARTS LIST

SHEET: 3 OF 3

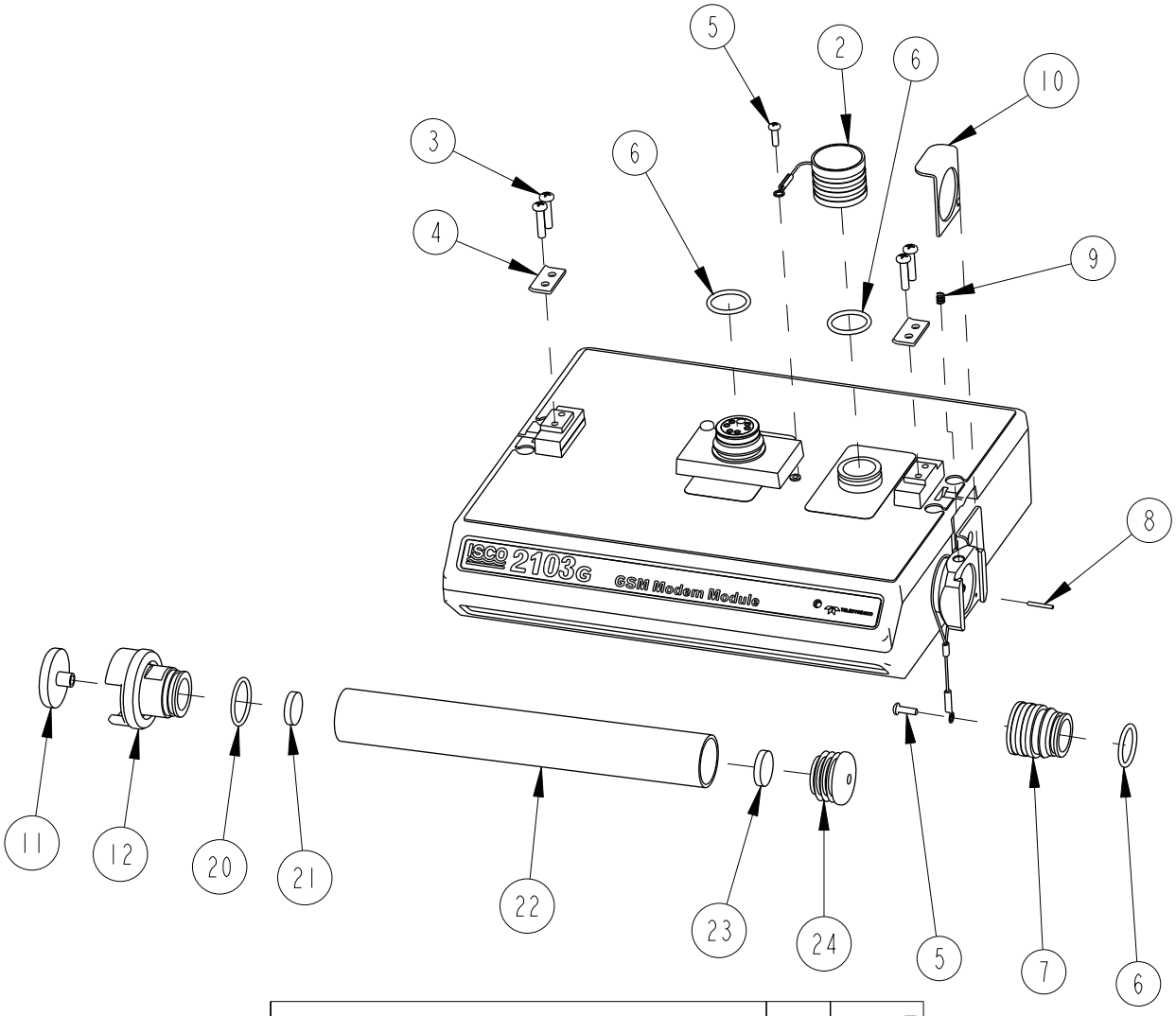
Isco, Inc.

REV: C | DATE: 01250

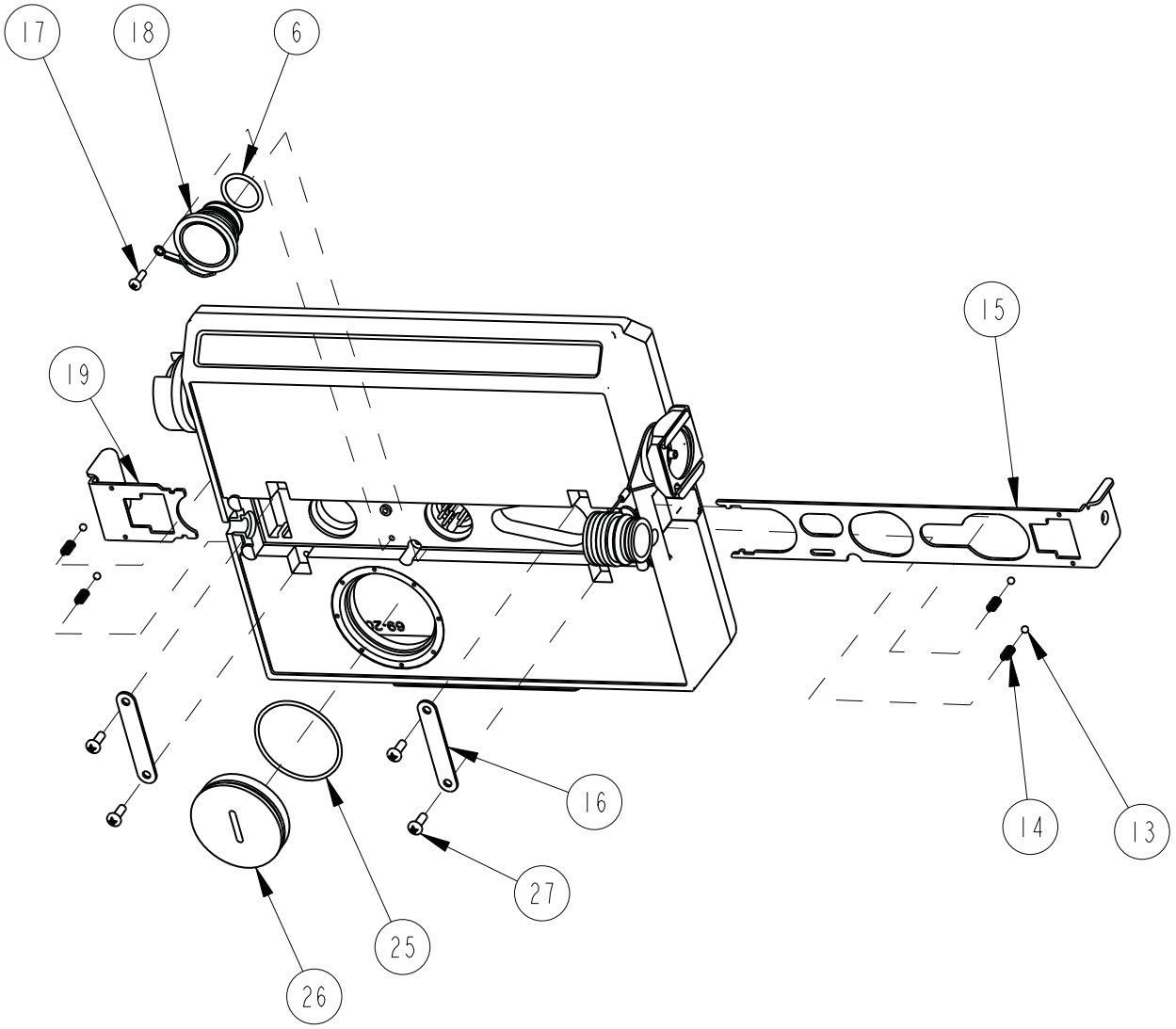
ITEM NO.	PART NUMBER	DESCRIPTION
1	602004060	DESICCANT ASSEMBLY
2	602004012	PLUG ASSY, MALE CONN(INCL'S ITEM 6)
3	231514920	SCREW, PH, SELF TAP, #6-19 X 5/8 SST
4	602003019	CLIP, NODE
5	231310140	SCREW, PH, SELF TAP, #4 X 3/8 SST
6	202100669	O RING, .669ID .79 XSECT, SILICONE
7	233010400	WASHER, FLAT, #4, SST
8	231514310	SCREW, PH, #4-40 X 5/8 SST
9	603113032	GASKET, CONNECTOR CAP
10	602005004	CAP, CONNECTOR MODIFIED
11	602005003	FILTER, INLINE AIR, FOR 25mm TUBING
12	609005001	STRAP, CONNECTOR CAP, MOD
13	201900102	BALL, .125 D SST
14	203011602	SPRING, .022 ∅ WIRE, .31 FREE LG
15	692003190	LATCH, LARGE
16	602003022	HOLD, LATCH
17	231611108	SCREW, PH, SELF TAP, #4 X 1/2 SST
18	602004013	PLUG ASSY. FEM CONN (INCL'S ITEM 6)
19	692003189	LATCH, SMALL
20	601113011	SPACER

NOTE: 1. For current prices and quotations on parts, contact Isco Service Department.
2. This list is subject to change without notice.

A.1.2 2103C/G Cellular Module (early version)



TELEDYNE ISCO, INC.				A
THIS DRAWING PREPARED IN ACCORDANCE WITH ANSI/ASME Y14.5M-1994	CREATED	DH	111609	DRAWING NO. 602002573
	DRAWN	DH	111609	SHEET 1 OF 3
SCALE 0.375	APPROVED	DH	111609	
REPLACEMENT PARTS LIST, 2103C & 2103G INTERFACE MODULE				


17
18
6
15
19
16
14
13
27
25
26

602002573

REPLACEMENT PARTS LIST

SHEET: 3 OF 3

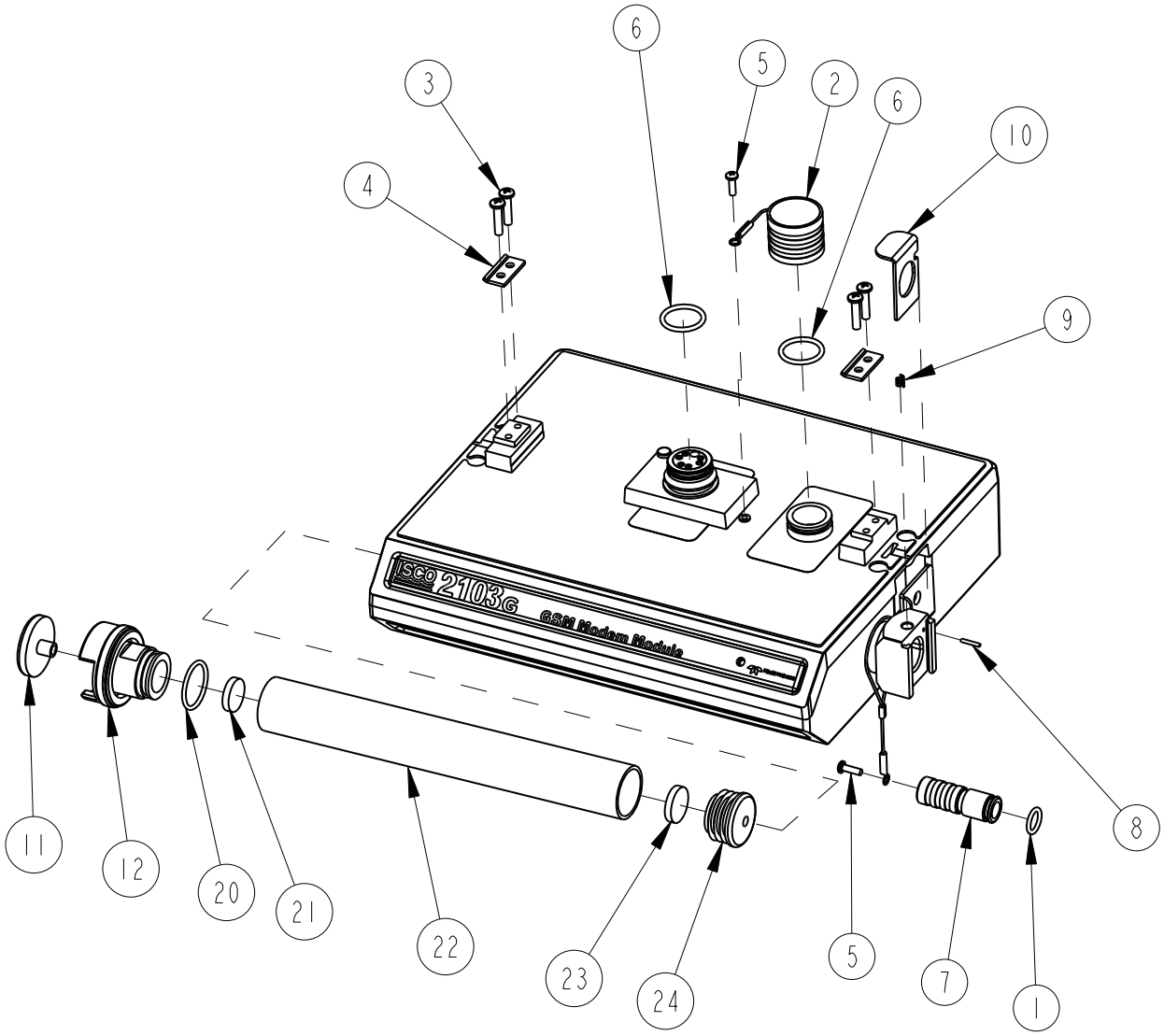
REV: A

TELEDYNE ISCO, INC.

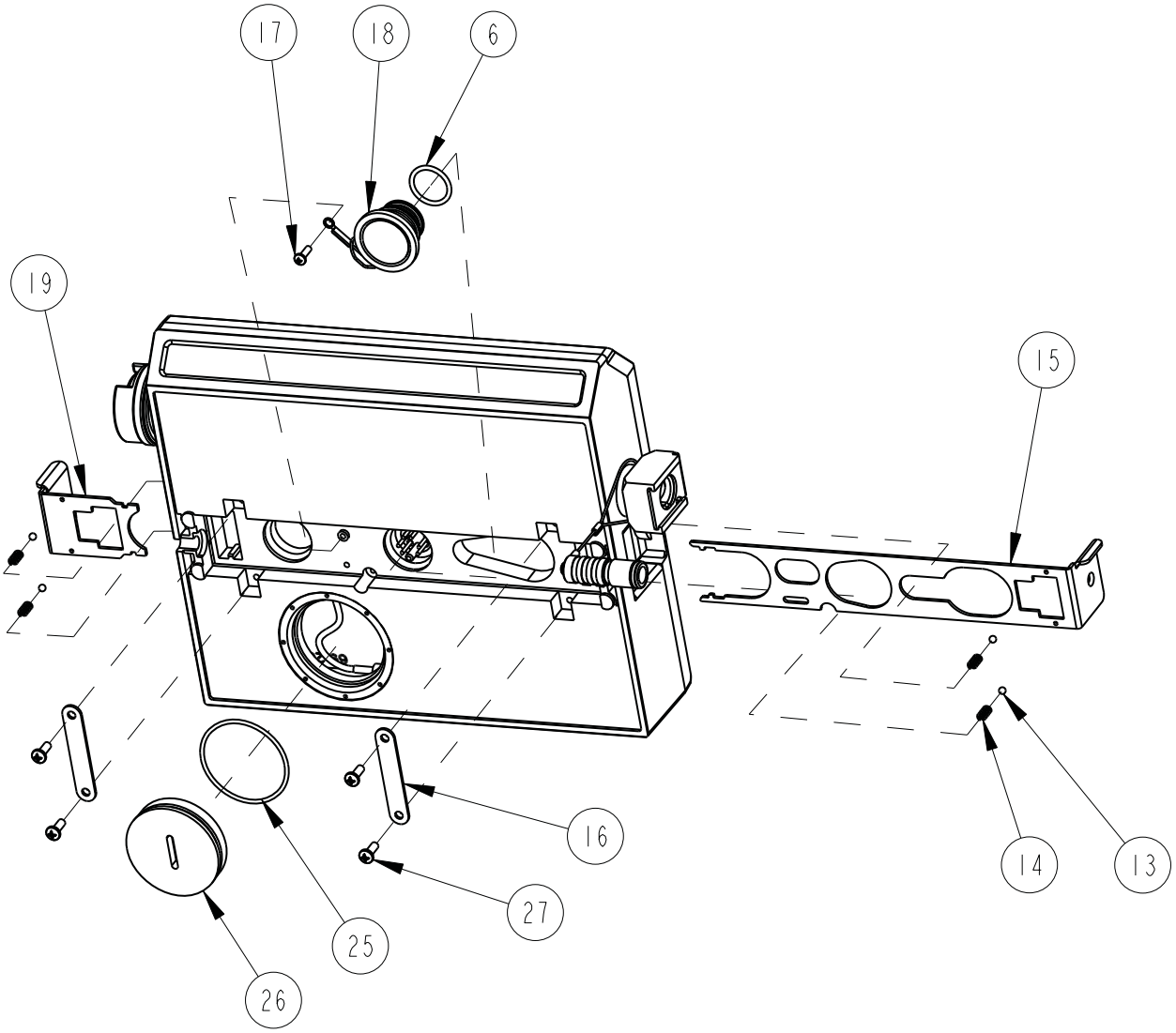
ITEM	PART NUMBER	DESCRIPTION
1		
2	602004012	CAP ASSY, MALE CONNECTOR
3	231514920	SCREW, PAN HEAD, SELF TAP, #6-19 X 5/8 SST
4	602003019	CLIP, NODE
5	231310140	SCREW, PAN HEAD, SELF TAP, #4 X 3/8 SST
6	202100669	O RING, .669 ID .079 XSEC, BUNA-N
7	602003076	PLUG FEMALE ANTENNA
8	236410408	PIN, SPRING .06 X .50 LONG SST
9	203011105	COMPRESSION SPRING, .026 ∅ WIRE, SST
10	602003018	ANTENNA CONNECTOR CLIP
11	602005003	FILTER, INLINE AIR, FOR 25mm TUBING
12	602004264	DESICCANT CAP ASSEMBLY
13	201900102	BALL, .125 ∅ 316 SST
14	203011602	SPRING, .022 ∅ WIRE, SST, .31 FREE LENGTH
15	692003190	LATCH, LARGE
16	602003022	HOLD, LATCH
17	231611108	SCREW, PAN HEAD, SELF TAP, #4 X 1/2 SST
18	602004013	PLUG ASSY, FEMALE CONN (INCLUDES ITEM 6)
19	692003189	LATCH, SMALL
20	202500017	O RING .676 ID .070 XSECT, BUNA-N
21	692203300	FRIT, .620 ∅ X .125 THICK
22	602003086	DESICCANT TUBE, 4.1 LONG
23	692203301	FRIT, .670 ∅ X .125 THICK
24	602003074	CAP PLUG MODIFICATION, DESICCANT
25	202307030	O RING 1.614 ID .070 XSECT, VITON
26	602003576	PLUG, MALE
27	231311206	SCREW, PAN HEAD, SELF TAP, #6-18 X 3/8, SST

NOTE: 1. For current prices and quotations on parts, contact Isco Service Department.
2. This list is subject to change without notice.

A.1.3 2103C/G Cellular Module (current version)



TELEDYNE ISCO, INC.				A
THIS DRAWING PREPARED IN ACCORDANCE WITH ANSI/ASME Y14.5M-1994	CREATED	DH	111609	DRAWING NO. 60200257 4
	DRAWN	DH	111609	SHEET 1 OF 3
SCALE 0.280	APPROVED	DH	111609	
REPLACEMENT PARTS LIST 2103C & 2103G MODULE				


17
18
6
19
15
16
14
13
27
25
26

602002574

REPLACEMENT PARTS LIST

SHEET: 3 OF 3

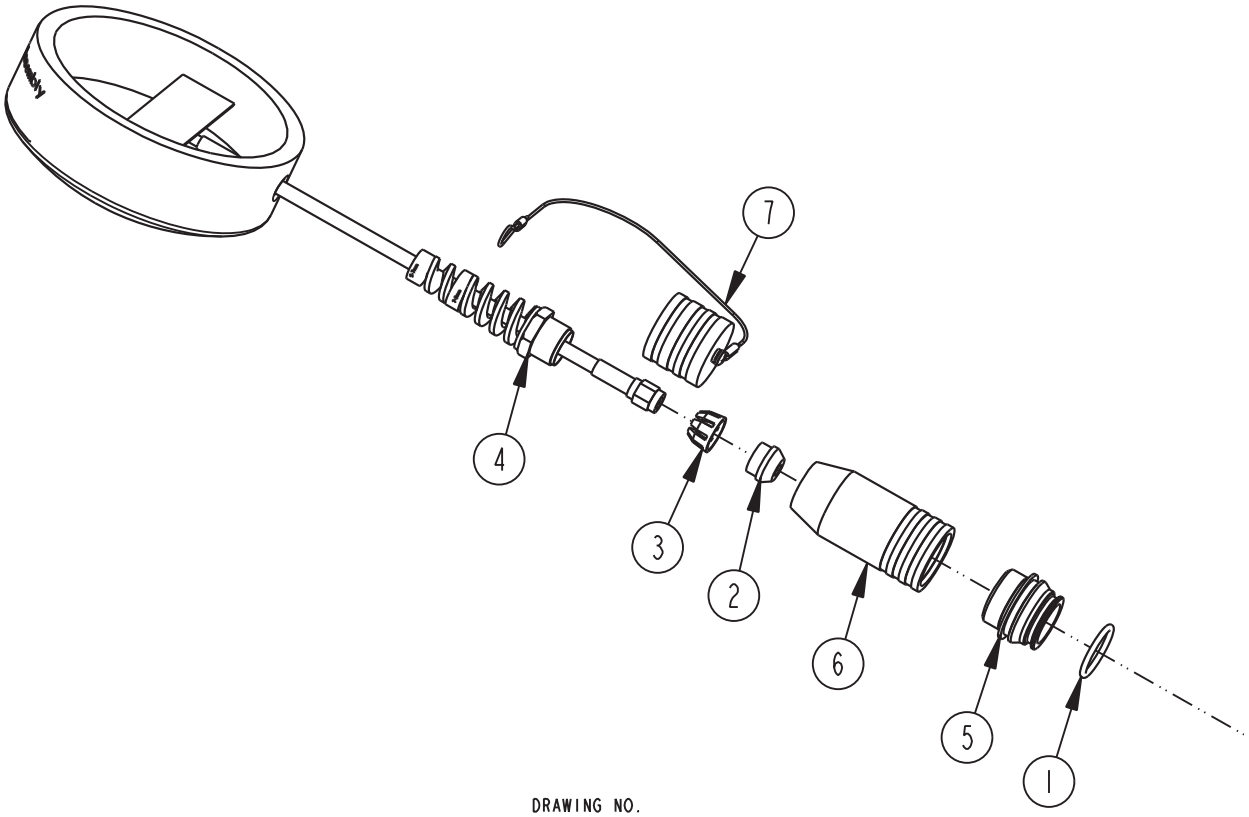
REV: A

TELEDYNE ISCO, INC.

ITEM	PART NUMBER	DESCRIPTION
1	202307012	O RING, .364 ID .070 XSECT, VITON
2	602004012	CAP ASSY, MALE CONNECTOR
3	231514920	SCREW, PAN HEAD, SELF TAP, #6-19 X 5/8 SST
4	602003019	CLIP, NODE
5	231310140	SCREW, PAN HEAD, SELF TAP, #4 X 3/8 SST
6	202100669	O RING, .669 ID .079 XSEC, BUNA-N
7	602003568	PLUG FEMALE ANTENNA
8	236410406	PIN, SPRING .06 X .38 LONG SST
9	203011105	COMPRESSION SPRING, .026 ∅ WIRE, SST
10	602003565	ANTENNA CONNECTOR CLIP
11	602005003	FILTER, INLINE AIR, FOR 25mm TUBING
12	602004264	DESICCANT CAP ASSEMBLY
13	201900102	BALL, .125 ∅ 316 SST
14	203011602	SPRING, .022 ∅ WIRE, SST, .31 FREE LENGTH
15	692003190	LATCH, LARGE
16	602003022	HOLD, LATCH
17	231611108	SCREW, PAN HEAD, SELF TAP, #4 X 1/2 SST
18	602004013	PLUG ASSY, FEMALE CONN (INCLUDES ITEM 6)
19	692003189	LATCH, SMALL
20	202500017	O RING .676 ID .070 XSECT, BUNA-N
21	692203300	FRIT, .620 ∅ X .125 THICK
22	602003086	DESICCANT TUBE, 4.1 LONG
23	692203301	FRIT, .670 ∅ X .125 THICK
24	602003074	CAP PLUG MODIFICATION, DESICCANT
25	202307030	O RING 1.614 ID .070 XSECT, VITON
26	602003576	PLUG, MALE
27	231311206	SCREW, PAN HEAD, SELF TAP, #6-18 X 3/8, SST

NOTE: 1. For current prices and quotations on parts, contact Isco Service Department.
2. This list is subject to change without notice.

A.1.4 In-Street Antenna (early version)



602002503

REPLACEMENT PARTS LIST

SHEET: 2 OF 2

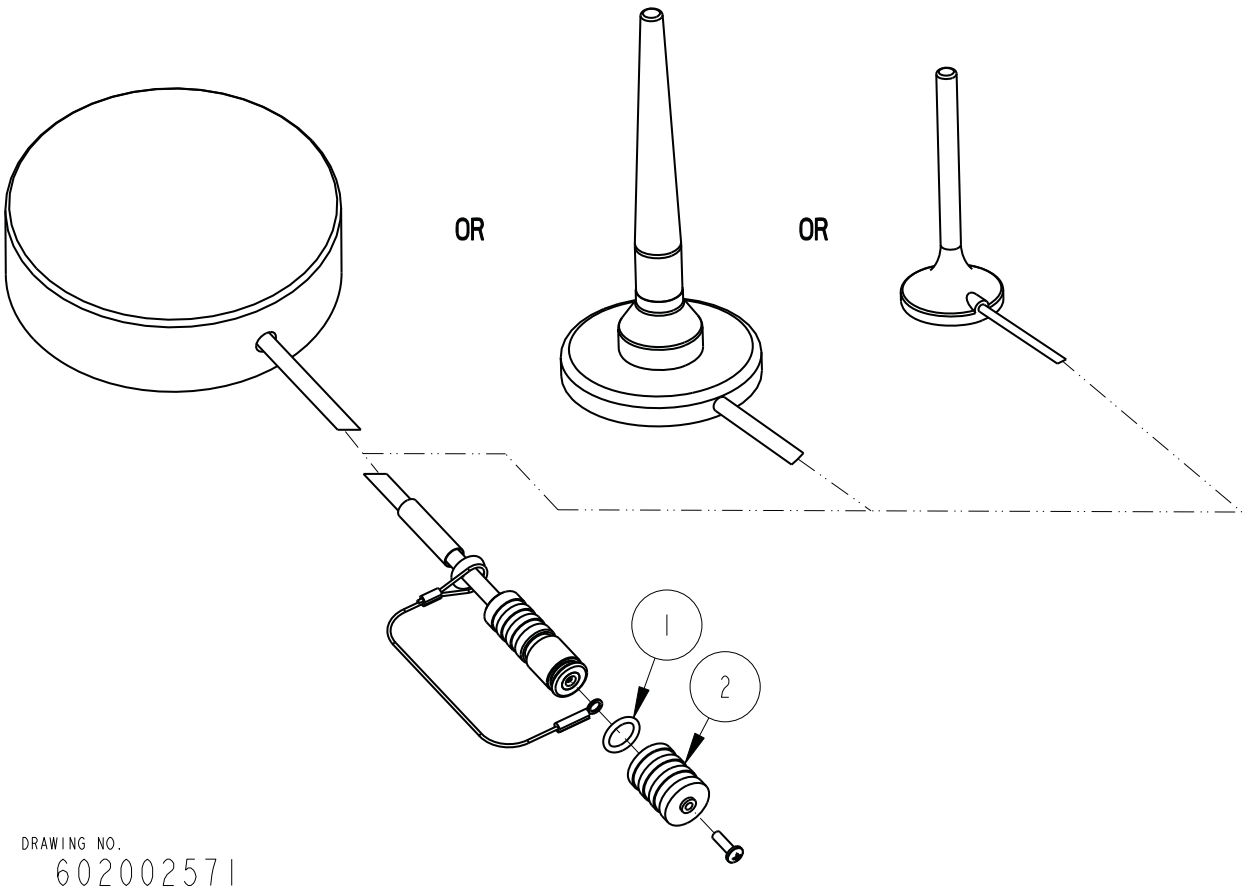
TELEDYNE ISCO, INC.

REV: | DATE: 06010

ITEM NO.	PART NUMBER	DESCRIPTION
1	202100669	O RING, .669 ID, .79 CROSS SECTION
2	209016968	CABLE GLAND
3	209016969	CAGE, CABLE GLAND
4	209016970	NUT, CABLE GLAND
5	602003238	NODE TOP CONNECTOR
6	602003504	CONNECTOR SHELL, 2100
7	602004034	CAP ASSEMBLY

NOTE: 1. For current prices and quotations on parts, contact Isco Service Department.
2. This list is subject to change without notice.

A.1.5 Current Antennas



DRAWING NO.
602002571
REPLACEMENT PARTS LIST,
ANTENNA ASSEMBLY

602002571

REPLACEMENT PARTS LIST

SHEET: 2 OF 2

TELEDYNE ISCO, INC.

REV: | DATE: 07243

ITEM NO.	PART NUMBER	DESCRIPTION
1	202307012	O-RING .364 ID .070 XSECT, VITON
2	602003581	CAP, MALE ANTENNA

NOTE: 1. For current prices and quotations on parts, contact Isco Service Department.
2. This list is subject to change without notice.

2103 Modem Module

Appendix B Accessories

B.1 How to Order

Accessories can be purchased by contacting Teledyne Isco's Customer Service Department.

Teledyne Isco
Customer Service Dept.
P.O. Box 82531
Lincoln, NE 68501 USA

Phone: (800) 228-4373
(402) 464-0231
FAX: (402) 465-3022

E-mail: IscoInfo@teledyne.com

B.2 General Accessories

2103 Instruction manual 69-2003-180
Flowlink Software . . . . . (call factory)
Maintenance Kit 60-2009-004
Silica Gel Desiccant 099-0011-03
Hydrophobic Filter 209-0093-93
Tubing, 10' Silicone 60-2003-104
Modem Cable for analog 2103 module 60-3214-020

B.2.1 Antennas

3" Magnetic for 2103C (early) 68-2000-032
5" Magnetic for 2103G (early) 68-2000-047
In-Street (early) 68-2000-031
Manhole Cover (early) 60-5314-779

3" Magnetic for 2103C (current) 60-2004-566
5" Magnetic for 2103G (current) 68-2000-047
In-Street (current) 60-2004-564
Manhole Cover (current) 60-5314-820

Manhole Antenna installation tool (only) 60-5314-898
SMA to SMB Adaptor cable 60-5314-891
(for connecting early-style antennas to current modules)

2103 Modem Module

Appendix C Material Safety Data Sheets

C.1 Overview

This appendix to the manual provides Material Safety Data Sheets for the desiccant used by the 2103 Modem Module.

Teledyne Isco cannot guarantee the accuracy of the data. Specific questions regarding the use and handling of the products should be directed to the manufacturer listed on the MSDS.

Material Safety Data Sheet

Indicating Silica Gel

Identity (Trade Name as Used on Label)

Manufacturer : MULTISORB TECHNOLOGIES, INC. (formerly Multiform Desiccants, Inc.)	MSDS Number* : M75
Address: 325 Harlem Road Buffalo, NY 14224	CAS Number* :
Phone Number (For Information): 716/824-8900	Date Prepared: July 6, 2000
Emergency Phone Number: 716/824-8900	Prepared By* : G.E. McKedy

Section 1 - Material Identification and Information

Components - Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	%*	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
Silica Gel SiO_2	98.0	6mg/m^3 (total dust)	10mg/m^3 (total dust)	
Cobalt Chloride	>2.0	0.05mg/m^3 (TWA cobalt metal dust & fume)	.05mg/m^3 (Cobalt, TWA)	
Non-Hazardous Ingredients				
TOTAL	100			

Section 2 - Physical/Chemical Characteristics

Boiling Point	N/A	Specific Gravity (H_20 = 1)	2.1
Vapor Pressure (mm Hg and Temperature	N/A	Melting Point	N/A
Vapor Density (Air =1)	N/A	Evaporation Rate (_____=1)	N/A
Solubility in Water	Insoluble, but will adsorb moisture.	Water Reactive	Not reactive, but will adsorb moisture.
Appearance and Odor	Purple crystals, no odor.		

Section 3 - Fire and Explosion Hazard Data

Flash Point and Methods Used	N/A	Auto-Ignition Temperature	N/A	Flammability Limits in Air % by Volume	N/A	LEL	UEL
Extinguisher Media	Dry chemical, carbon dioxide and foam can be used.						
Special Fire Fighting Procedures	Water will generate heat due to the silica gel which will adsorb water and liberate heat.						
Unusual Fire and Explosion Hazards	When exposed to water, the silica gel can get hot enough to reach the boiling point of water. Flooding with water will reduce the temperature to safe limits.						

Section 4 - Reactivity Hazard Data

STABILITY ☐**Stable** ☐**Unstable**	Conditions To Avoid	Moisture and high humidity environments.
Incompatibility (Materials to Avoid)	Water.	
Hazardous Decomposition Products	Carbon dioxide, carbon monoxide, water	
HAZARDOUS POLYMERIZATION ☐May Occur	Conditions To Avoid	None.

*Optional

Section 5 - Health Hazard Data

PRIMARY ROUTES OF ENTRY	☐Inhalation ☐Skin Absorption	☐Ingestion ☐Not Hazardous	**CARCINOGEN LISTED IN**	☐NTP ☐IARC Monograph	☐OSHA ☐Not Listed
HEALTH HAZARDS	Acute	May cause eye, skin and mucous membrane irritation.			
	Chronic	Prolonged inhalation may cause lung damage.			
Signs and Symptoms of Exposure	Drying and irritation.				
Medical Conditions Generally Aggravated by Exposure	Asthma.				
EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary.					
Eye Contact	Flush with water for at least 15 minutes.				
Skin Contact	Wash affected area with soap and water.				
Inhalation	Remove affected person to fresh air.				
Ingestion	Drink at least 2 glasses of water.				

Section 6 - Control and Protective Measures

Respiratory Protection (Specify Type)	Use NIOSH approved dust mask or respirator.		
Protective Gloves	Light cotton gloves.	Eye Protection	Safety glasses.
VENTILATION TO BE USED	☐ Local Exhaust	☐Mechanical (General)	☐Special
	☐Other (Specify)		
Other Protective Clothing and Equipment	None.		
Hygienic Work Practices	Avoid raising dust. Avoid contact with skin, eyes and clothing.		

Section 7 - Precautions for Safe Handling and Use/Leak Procedures

Steps to be Taken if Material Is Spilled Or Released	Sweep or vacuum up and place the spilled material in a waste disposal container. Avoid raising dust.
Waste Disposal Methods	Dispose in an approved landfill according to federal, state and local regulations.
Precautions to be Taken In Handling and Storage	Cover promptly to avoid blowing dust. Wash after handling.
Other Precautions and/or Special Hazards	Keep in sealed containers away from moisture. The silica gel will readily adsorb moisture.

*Optional Indicating Silica Gel

MULTISORB
Multisorb Technologies Inc.

MATERIAL SAFETY DATA SHEET

Effective Date March 8, 2005
MSDS Number M163

Section 1 – Product and Company Information

Product Name: **Silica gel, indicating, yellow**

Product Use: Desiccant, absorbent
Grades: Silica gel, indicating
Synonyms: Amorphous silica gel, SiO_2, silicon dioxide (amorphous)

Company; Multisorb Technologies, Inc.
Street Address: 325 Harlem Road
City, State, Zip, Country: Buffalo, NY 14224-1893 USA

Telephone Number: (716) 824 8900 [USA] Monday - Friday (8:00 - 5:00 EDT)
Fax Number: (716) 824 4091 [USA]
Website / E-Mail : multisorb.com

Section 2 – Composition / Information on Ingredients

Component Name	CAS Number	% by Weight
Synthetic amorphous silica gel (SiO_2)	112926-00-8	100
Phenolphthalein	77-09-08	100 ppm

While this material is not classified, this MSDS contains valuable information critical to the safe handling and proper use of this product. This MSDS should be retained and available for employees and other users of this product.

Section 3 – Hazard Identification

Emergency Overview: A yellow bead or granular material that poses little or no immediate hazard. This material is not combustible.

Potential Health Effects:

Eyes: Dust and or product may cause eye discomfort and irritation seen as tearing and reddening.

Skin: The product dust may cause drying of the skin. Silica gel may get hot enough to burn skin when it adsorbs moisture rapidly. Use an excess of water to cool the silica gel.

Ingestion: Material is not toxic and will pass through the body normally.

Inhalation: Slight irritation is possible but none is expected.

Medical Effects Generally Aggravated by Exposure: Respiratory ailments.

Chronic Effects/Carcinogenity: May cause eye, skin and mucous membrane irritation and drying.

Section 4 – First Aid Measures

Eyes: Rinse the eyes well with water while lifting the eye lids. If irritation persists, consult a physician.

Skin: Wash affected area with soap and water.

Ingestion: Ingestion is unlikely, this material will pass through the body normally.

Inhalation: Remove the affected person to fresh air and get medical attention if necessary.

Notes to Physician: Not applicable

Section 5 – Fire Fighting Measures

Flammable Properties: Not flammable

Flash Point: Not applicable **Method:** Not applicable

Flammable Limits: Not flammable

Lower Flammability Limit: Not applicable

Upper Flammability Limit: Not applicable

Autoignition Temperature: Not applicable

Hazardous Combustion Products: Not applicable

Extinguishing Media: Use extinguishing media that is appropriate for the surrounding fire. Silica gel is not combustible.

Fire Fighting Instructions: Not combustible

Unusual Fire and Explosion Hazards: None

Section 6 – Accidental Release Measures

Spill: Sweep or vacuum up and place the spilled material in a waste disposal container. Avoid raising dust. Wash with soap and water after handling.

Section 7 – Handling and Storage

Handling: Avoid raising dust and minimize the contact between worker and the material. Practice good hygienic work practices.

Storage: Store in a cool, dry location. Keep in sealed containers away from moisture. The silica gel will readily adsorb moisture.

Section 8 – Exposure Controls/Personal Protection

Engineering Controls: Use exhaust ventilation to keep the airborne concentrations below the exposure limits.

Respiratory Protection: Use NIOSH approved respirator when the air quality levels exceed the TLV's.

Skin Protection: Light gloves will protect against abrasion and drying of the skin.

Eye Protection: Safety glasses.

Component Name	Exposure Limits		
	OSHA PEL	**ACGIH TLV**	**Other Recommended Limits**
Silica gel	TWA 20 mppcf (80 mg / m^3 % SiO_2)	TWA 10 mg / m^3	NIOSH REL TWA 6 mg / m^3 IDLH 3000 mg / m^3
Phenolphthalein	Not Applicable	Not Applicable	Not Applicable

Section 9 – Physical and Chemical Properties

Appearance: Yellow beads or granules

Odor: None

Physical State: Solid bead

PH: Not applicable

Vapor Pressure: Not applicable

Vapor Density: Not applicable

Boiling Point: 4046° F (2230° C)

Melting Point: 3110° F (1710° C)

Solubility: Insoluble in water

Specific Gravity: 2.1

Section 10 – Stability and Reactivity

Stability: Stable

Conditions to avoid: Moisture and high humidity environments.

Incompatibility: Water, fluorine, oxygen difluoride, chlorine trifluoride

Hazardous Decomposition Products: None

Hazardous Polymerization: Will not occur

Section 11 – Toxicological Information

This product and its components are not listed on the NTP or OSHA Carcinogen lists.

Animal Toxicology Tests for DOT Hazard classification
(Tests Conducted on finely ground silica gel)

1 - hour LC_{50} (rat) > 2 mg / l
48 - hour oral LD_{50} (rat) est. > 31,600 mg / kg
48 - hour dermal LD_{50} (rabbit) est. > 2,000 mg / kg
Considered an ocular irritant

Human Toxicology Silica gel is a synthetic amorphous silica not to be confused with crystalline silica. Epidemiological studies indicate low potential for adverse health effects. In the activated form, silica gel acts as a desiccant and can cause a drying irritation of the mucous membranes and skin in cases of severe exposure. Multisorb Technologies Inc. knows of no medical conditions that are abnormally aggravated by exposure to silica gel. The primary route of entry is inhalation of dust.

Section 12 – Ecological Information

Not known to have any adverse effect on the aquatic environment. Silica gel is insoluble and non-toxic.

Section 13 – Disposal Information

Disposal Information If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Materials of a hazardous nature that contact the product during normal use may be retained on the product. The user of the product must identify the hazards associated with the retained material in order to assess the waste disposal options. Dispose according to federal, state and local regulations.

Section 14 – Transportation Information

U.S. Department of Transportation Shipping Name: Not classified as a hazardous material. Not regulated.

Section 15 – Regulatory Information (Not meant to be all inclusive - selected regulations represented)

TSCA Listed: Yes

DSL/NDSL (Canadian) Listed: Yes

OSHA: TWA 20 mppcf (80 mg / m^3 % SiO_2) for Silica gel

NIOSH: REL TWA 6 mg / m^3 IDLH 3,000 mg / m^3 for silica gel
Animal tests conducted in 1976 - 1978. 18 month exposure at 15 mg / m^3 showed silica deposition in respiratory macrophages and lymph nodes, minimum lung impairment, no silicosis.

ACGIH: TLV - 10 mg / m^3 for Silica gel

DOT: Not classified as a hazardous material.

Section 16 – Other Information

HMIS – Hazardous Materials Identification System

HMIS Rating	
Health	0
Flammability	0
Reactivity	0

0 - minimal hazard, 1 - slight hazard, 2 - moderate hazard, 3 - serious hazard, 4 - severe hazard

This MSDS was prepared by: George E. Mckedy
Senior Applications Development Specialist
Multisorb Technologies, Inc.

This data and recommendations presented in this data sheet concerning the use of our product and the materials contained therein are believed to be correct but does not purport to be all inclusive and shall be used only as a guide. However, the customer should determine the suitability of such materials for his purpose before adopting them on a commercial scale. Since the use of our products is beyond our control, no guarantee, expressed or implied, is made and no responsibility assumed for the use of this material or the results to be obtained therefrom. Information on this form is furnished for the purpose of compliance with Government Health and Safety Regulations and shall not be used for any other purposes. Moreover, the recommendations contained in this data sheet are not to be construed as a license to operate under, or a recommendation to infringe, any existing patents, nor should they be confused with state, municipal or insurance requirements, or with national safety codes.

2103 Modem Module

Index

Numerics

2103C, 3-1
2103c antenna
  connecting early versions, 3-4
  current, 3-6
  current in-street, 3-7
  current mag mount, 3-6
  current manhole lid, 3-7
  early, 3-2
  early in-street, 3-3
  early mag mount, 3-3
  early manhole lid, 3-4
  versions, 3-2
2103G, 4-1
2103g antenna
  connecting early versions, 4-6
  current, 4-8
  current in-street, 4-9
  current mag mount, 4-8
  current manhole lid, 4-9
  early, 4-4
  early in-street, 4-5
  early mag mount, 4-5
  early manhole lid, 4-6
  versions, 4-4

A

accessories, B-1
alarms, 2-10
analog modem, 2-3
antennas, 3-2, 4-4

C

components
  bottom view, 1-3
  identification, 1-2
  top view, 1-2
connectors, 2-2
  analog modem cable, 1-5
  analog modem communication, 1-5, 2-5
contact information, 2-1, 6-3, A-1, B-1
  technical service, 1-6, 6-3

D

desiccant, 6-2

F

FCC compliance, 2-3
Flowlink, 2-6
  alarms, 2-10
  connection information, 2-9
  modem connection, 2-9
  pushed data, 2-14
  text messaging, 2-10

G

GPRS access point, 4-10

I

installation, 2-2

L

latches, 2-2

M

maintenance, 6-1
  desiccant, 6-2
  hydrophobic filter, 6-3
  o-rings, 6-3
MODBUS, 5-1
  acronyms, 5-5
  configurations, 5-3
  glossary of terms, 5-4
  register specifications, 5-5
modem modules
  connecting, 2-9
  power conservation, 2-12
  pushed data, 2-14
  text messaging, 2-10
MSDS, C-1

P

parts, A-1, B-1
power conservation, 2-12
  equation, 2-13
  modem modules, 2-12
pushed data, 2-14

R

replacement parts, A-1

S

safety information, 1-6, 2-1, C-1
SIM card (2103g), 4-1
software configuration, 2-6

specifications, 1-4
stacking, 2-2, 2-3

T

text messaging, 2-10

产品中有毒有害物质或元素的名称及含量

Name and amount of Hazardous Substances or Elements in the product

部件名称 Component Name	有毒有害物质或元素 Hazardous Substances or Elements					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二联苯 (PBDE)
线路板 Circuit Boards	X	O	O	O	O	O

产品中有毒有害物质或元素的名称及含量：Name and amount of Hazardous Substances or Elements in the product

O: 表示该有毒有害物质在该部件所有均质材料中的含量均在ST/ 标准规定的限量要求以下。

O: Represent the concentration of the hazardous substance in this component's any homogeneous pieces is lower than the ST/ standard limitation.

X：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出ST/ 标准规定的限量要求。

(企业可在此处，根据实际情况对上表中打"X" 的技术原因进行进一步说明。)

X: Represent the concentration of the hazardous substance in this component's at least one homogeneous piece is higher than the ST/ standard limitation.

(Manufacturer may give technical reasons to the "X"marks)

环保使用期由经验确定。

The Environmentally Friendly Use Period (EFUP) was determined through experience.

生产日期被编码在系列号码中。前三位数字为生产年(207 代表 2007 年) 。随后的一个字母代表月份：A 为一月，B 为二月，等等。

The date of Manufacture is in code within the serial number. The first three numbers are the year of manufacture (207 is year 2007) followed by a letter for the month. "A" is January, "B" is February and so on.

DECLARATION OF CONFORMITY

CE
ISM1-A

Application of Council Directive:	89/336/EEC – The EMC Directive 73/23/EEC – The Low Voltage Directive
Manufacturer's Name:	Teledyne Isco, Inc.
Manufacturer's Address:	4700 Superior, Lincoln, Nebraska 68504 USA Mailing Address: P.O. Box 82531, Lincoln, NE 68501
Equipment Type/Environment:	Laboratory Equipment for Light Industrial/Commercial Environments
Trade Name/Model No:	2103 Modem Module
Year of Issue:	2001
Standards to which Conformity is Declared:	FCC part is Sub part B, IC ES-003, En 55022:1998, EN 55024:1998 EMC Requirements for Information Technology Equipment EN 60950 Safety Requirements for Information Technology Equipment FCC Part 68

Standard	Description	Severity Applied	Performance Criteria
EN61000-4-2	Electrostatic Discharge	Level 2 - 4kV contact discharge Level 3 - 8kV air discharge	A A
EN61000-4-3	Radiated RF Immunity	80 MHz to 1000MHz 80% AM at 1kHz Level 1 – 10V/m	A
EN61000-4-4	Electrical Fast Transient	Level 1 – 1kV on I/O lines	A
EN61000-4-5	Surge on I/O Lines	1kV common mode, 0.5KV differential mode	A
*EN61000-4-6	Conducted RF on I/O lines	150 kHz to 80 MHz, 3V rms, 80% modulated	*C
CISPR11/ EN 55011	RF Emissions	Group 1, Class A Industrial, Scientific, and Medical Equipment	

* Between 5 and 7 mega Hz the modem will inadvertently disconnect from the computer. A manual reconnection procedure is required to restablish a connection.

We, the undersigned, hereby declare that the design of the equipment specified above conforms to the above Directive(s) and Standards as of July 1, 2001.

William Foster
USA Representative

TELEDYNE ISCO
A Teledyne Technologies Company

William Foster
Director of Engineering
Teledyne Isco, Inc.
4700 Superior Street
Lincoln, Nebraska 68504

Phone: (402) 464-0231
Fax: (402) 464-4543

60-2002-156
Rev. B

DECLARATION OF CONFORMITY

CE
ISM1-A

Application of Council Directive:	89/336/EEC – The EMC Directive 73/23/EEC – The Low Voltage Directive
Manufacturer's Name:	Teledyne Isco, Inc.
Manufacturer's Address:	4700 Superior, Lincoln, Nebraska 68504 USA Mailing Address: P.O. Box 82531, Lincoln, NE 68501
Equipment Type/Environment:	Laboratory Equipment for Light Industrial/Commercial Environments
Trade Name/Model No:	2191 Battery Module
Year of Issue:	2001
Standards to which Conformity is Declared:	EN 61326-1998 EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use EN 61010-1 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use.

Standard	Description	Severity Applied	Performance Criteria
EN61000-4-2	Electrostatic Discharge	Level 2 - 4kV contact discharge Level 3 - 8kV air discharge	B B
EN61000-4-3	Radiated RF Immunity	80 MHz to 1000MHz 80% AM at 1kHz Level 1 – 10V/m	B
EN61000-4-4	Electrical Fast Transient	Level 1 – 1kV on I/O lines	B
EN61000-4-5	Surge on I/O Lines	1kV common mode, 0.5KV differential mode	B
EN61000-4-6	Conducted RF on I/O lines	150 kHz to 80 MHz, 3V rms, 80% modulated	B
CISPR11/ EN 55011	RF Emissions	Group 1, Class A Industrial, Scientific, and Medical Equipment	

We, the undersigned, hereby declare that the design of the equipment specified above conforms to the above Directive(s) and Standards as of July 1, 2001.

William Foster

William Foster
USA Representative

TELEDYNE ISCO
A Teledyne Technologies Company

William Foster
Director of Engineering
Teledyne Isco, Inc.
4700 Superior Street
Lincoln, Nebraska 68504

Phone: (402) 464-0231
Fax: (402) 464-4543

60-2002-158
Rev A

Warranty

DECLARATION OF CONFORMITY

ISM1-A

Application of Council Directive:	2004/108/EC -The EMC Directive 2002/96/EC – The WEEE Directive
Manufacturer's Name:	Teledyne Isco, Inc.
Manufacturer's Address:	4700 Superior, Lincoln, Nebraska 68504 USA Mailing Address: P.O. Box 82531, Lincoln, NE 68501
Equipment Type/Environment:	Laboratory Equipment for Light Industrial/Commercial Environments:
Trade Name/Model No:	2103G
Year of Issue:	2007
Standards Conformity is Declared:	EN61326-1:2006 EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

Standard	Description	Severity Applied	Performance Criteria
EN61000-4-2	Electrostatic Discharge	Level 2 - 4kV contact discharge Level 3 - 8kV air discharge	A A
EN61000-4-3	Radiated RF Immunity	80 MHz to 1000MHz 80% AM at 1kHz Level 1 – 1V/m	A
CISPR11/ EN 55011	RF Emissions	Group 1, Class A Industrial, Scientific, and Medical Equipment	

I, the undersigned, hereby declare that the design of the equipment specified above conforms to the above Directive(s) and Standards as of April 20, 2007.

William Foster
USA Representative

TELEDYNE ISCO
A Teledyne Technologies Company

William Foster
Director of Engineering
Teledyne Isco, Inc.
4700 Superior Street
Lincoln, Nebraska 68504

Phone: (402) 464-0231
Fax: (402) 464-4543

60-2002-504

Teledyne Isco One Year Limited Factory Service Warranty*

This warranty exclusively covers Teledyne Isco instruments, providing a one-year limited warranty covering parts and labor.

Any instrument that fails during the warranty period due to faulty parts or workmanship will be repaired at the factory at no charge to the customer. Teledyne Isco's exclusive liability is limited to repair or replacement of defective instruments. Teledyne Isco is not liable for consequential damages.

Teledyne Isco will pay surface transportation charges both ways within the 48 contiguous United States if the instrument proves to be defective within 30 days of shipment. Throughout the remainder of the warranty period, the customer will pay to return the instrument to Teledyne Isco, and Teledyne Isco will pay surface transportation to return the repaired instrument to the customer. Teledyne Isco will not pay air freight or customer's packing and crating charges. This warranty does not cover loss, damage, or defects resulting from transportation between the customer's facility and the repair facility.

The warranty for any instrument is the one in effect on date of shipment. The warranty period begins on the shipping date, unless Teledyne Isco agrees in writing to a different date.

Excluded from this warranty are normal wear; expendable items such as charts, ribbon, lamps, tubing, and glassware; fittings and wetted parts of valves; and damage due to corrosion, misuse, accident, or lack of proper maintenance. This warranty does not cover products not sold under the Teledyne Isco trademark or for which any other warranty is specifically stated.

No item may be returned for warranty service without a return authorization number issued by Teledyne Isco.

This warranty is expressly in lieu of all other warranties and obligations and Teledyne Isco specifically disclaims any warranty of merchantability or fitness for a particular purpose.

The warrantor is Teledyne Isco, 4700 Superior, Lincoln, NE 68504, U.S.A.

*** This warranty applies to the USA and countries where Teledyne Isco does not have an authorized dealer. Customers in countries outside the USA, where Teledyne Isco has an authorized dealer, should contact their Teledyne Isco dealer for warranty service.**

Before returning any instrument for repair, please call, fax, or e-mail the Teledyne Isco Service Department for instructions. Many problems can often be diagnosed and corrected over the phone, or by e-mail, without returning the instrument to the factory.

Instruments needing factory repair should be packed carefully, and shipped to the attention of the service department. Small, non-fragile items can be sent by insured parcel post. **PLEASE BE SURE TO ENCLOSE A NOTE EXPLAINING THE PROBLEM.**

Shipping Address:	Teledyne Isco - Attention Repair Service 4700 Superior Street Lincoln, NE 68504 USA
Mailing Address:	Teledyne Isco PO Box 82531 Lincoln, NE 68501 USA
Phone:	Repair service: (800) 775-2965 (lab instruments) (866) 298-6174 (samplers & flow meters) Sales & General Information: (800) 228-4373 (USA & Canada)
Fax:	(402) 465-3001
Email:	IscoService@teledyne.com

February 28, 2012 P/N 60-1002-040 Rev G

TELEDYNE ISCO
Everywhereyoulook™